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ABSTRACT

This self-pacing program is the result of a cooperative curriculum development project between The Maryland Department of Education and The Baltimore County Schools. Included is a teachers guide for the use of the materials. The philosophy of this approach is that of individualization of instruction wherein the student moves at a pace commensurate with his ability and background. He studies a topic, either individually or with a small group, then he takes a test measuring mastery of that material. The test is marked "complete" or "incomplete." If he "completes" the topic unit, he proceeds to the next; if not, he does some remedial work until he "completes" the topic unit. It is suggested that written progress reports be kept for each student continuously and that grades for the course be based on number of units completed. The content of this course includes systems of linear open sentences, polynomials and factoring, rational numbers and experssions, relations and functions, real numbers, complex numbers, logarithms, progressions and the binomial expansion, probability, quadratic systems, and matrices. Also included is an extensive itemized list of behavioral objectives for each topic, student assignments for each topic, and tests and keys for each topic unit. (Author/CT)

A SELF-PACING PROGRAM IN ALGEBRA, VOLUME II

- A Tentative Guide -

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A Cooperative Project
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and
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SE 011 312

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The Self-Pacing Program in Algebra which this letter accompanies is the result of a cooperative curriculum development project between the State Department of Education and a local school system. We in the State Department of Education are most anxious to encourage and support such ventures. Cooperation in curriculum development between our staff and that of a local school system, as well as cooperation between local school systems, should have the effect of multiplying our available resources.

One of the serious problems facing educators today is that of rapidly increasing costs to the taxpayer. Shared efforts in curriculum construction which hopefully minimize duplication and maximize quality, may help to hold down these costs. At the same time, when these cooperative projects attain a product which encourages diversity and creativeness rather than conformity, then resources can be made more immediately available to various curriculum areas. It is hoped that the curriculum materials contained herein will measure up to these goals and will serve as one more step toward full and effective progress in mathematics education for Maryland.

Sincerely,

James A. Sensenbaugh

State Superintendent of Schools

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FOREWORD

In recent years, there has been increasing interest in the development of mathematics programs which emphasize individualization of instruction. This interest has been generated by a desire to provide each student with the opportunity to use the instructional materials best suited to his needs. Among the programs considered have been a number of efforts involving computer-assisted instruction, programed instruction and self-pacing programs.

Each of the preceding programs, of necessity, requires increased expenditures in time, personnel, materials, and money. Of the programs considered, the self-pacing format offers increased individualization of instruction with minimum expenditures for specialized materials and equipment.

The Office of Mathematics of the Board of Education of Baltimore County, in cooperation with the Maryland State Department of Education has developed A Self-Pacing Program in Algebra. It is hoped that this program will serve as a model for future efforts which use self-pacing techniques and offer suggestions for their implementation.

Any suggestions for improvement of this program would be greatly appreciated. The evaluation sheet is enclosed for this purpose.

Special thanks are offered to Mrs. Carolyn Bruder and Mrs. Linda Tieman for their untiring efforts in typing and reproducing this guide.

PHILOSOPHY

Educators agree that students learn at different rates. Although curriculum specialists and teachers have attempted to devise programs to meet individual needs in past years, much work remains to achieve the goal of individualized instruction.

There is a definite need for developing a system which provides for individualization of instruction and greater flexibility. Lack of differentiation in the teaching process results in boredom for students for whom the pace is too slow and frustration for those students for whom the pace is too fast. Often this leads to problems of classroom control and high failure rates.

One approach which is attracting attention in educational circles is that of self-pacing programs, wherein the student moves at a pace commensurate with his ability and background. An example of efforts along this line is the Individually Prescribed Instruction program of the Oakleaf Schools in Pittsburgh. In addition, an increasing number of textbook publishers have been influenced by this trend.

Preliminary returns of experimentation and pilot programs indicate that emphasis upon student success results in a more positive attitude by the student toward the subject, teacher, and school environment.

Suggestions for Implementation

The successful implementation of any self-pacing program in mathematics depends upon the cooperation and teamwork of the administration and the teaching staff.

The first administrative concern for the implementation of a self-pacing program of instruction is the construction of the school master schedule. To provide the necessary flexibility for such a program, classes should be scheduled in a parallel manner whenever possible. For example, if a school has eight algebra classes, they might be scheduled during the same period of the day or in two blocks of four classes.

Secondly, these classes should be located in adjacent rooms or as near as possible to each other for greater flexibility. Ideally, an additional room should be assigned to the teaching staff during each period to provide extra space for small group instruction, independent study, student-teacher conferences, and testing.

Another feature of scheduling should be the provision of at least one common planning period during the school day for all teachers in the program. This provides the team with opportunities to discuss common problems, evaluate materials, plan daily lessons, regroup students, and develop new materials.

Because of the varied activities occurring simultaneously in any self-pacing program, the teacher should be provided with sufficient paraprofessional help. The possibility of assigning student teachers from nearby colleges to each department member should also be considered. If this is not possible, one or two student teachers might be assigned to the entire department. These college students could then be assigned to the teachers indicating the greatest need on a day-by-day basis. Besides providing a service to the teachers and students, this experience can be immensely valuable to the professional growth of the student teacher. He will have the opportunity to work with and observe more than one experienced teacher, work with small groups before encountering the traditional large class, and develop teaching skills necessary in an informal situation.

A further source of paraprofessional help consists of student volunteers who are advanced in mathematics. Student volunteers can be extremely useful in tutoring individuals within the classroom, correcting tests, and performing other clerical functions.

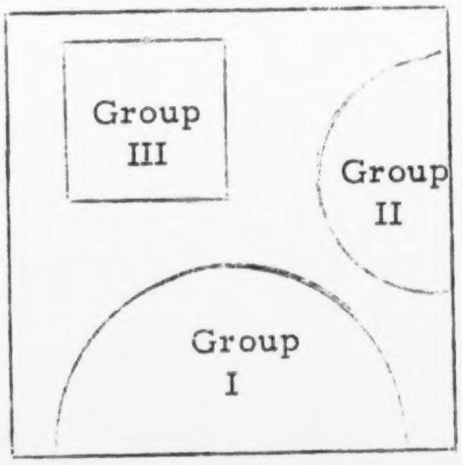
Also, every community contains a nucleus of parents who are eager to serve their community and schools. These people should not be overlooked when searching for additional classroom help.

Part of the role of the teacher in the self-pacing program is to coordinate the activities of the paraprofessional team which might consist of a student teacher, a volunteer student, and a community volunteer.

Class size is an important factor in the effectiveness of a self-pacing program. Thus, the administration should make every effort to reduce class sizes to provide for greater individualization of instruction. Initially, a teacher might be assigned about 20 to 25 students. However, after regrouping has occurred several times, it is possible that one teacher could have a class of 35 students, while a second teacher has only 10.

In the ideal self-pacing program a building might be designed to include large rooms with portable separators. Modular scheduling with several consecutive modules of time devoted to independent study may be a feature of the new curricula. It is hoped that the role of the paraprofessional will be minimized in the ideal situation by assigning several qualified teachers to each class.

It is evident that the role of the teacher will become more complex in the self-pacing program. Each teacher will direct the activities of individual students in two or more groups. This means that more than one activity in the traditional sense must be prepared. The teacher may choose to spend the entire period instructing one group and providing meaningful activities for the other group. These latter groups can be assigned to paraprofessional aides. A typical situation might find the teacher instructing a group of 12 to 15 students in one part of the room, a student teacher teaching a smaller group of 5 to 7 students in another part of the room or in a different room and a student volunteer helping individuals in a third place. A suggested arrangement of the room is shown below.



The physical arrangement may change from day to day depending upon the activities planned.

The teacher may wish to spend part of his time working with each group or with individuals. These suggestions in no way exhaust the possibilities for grouping. It may be useful for special purposes to teach the entire section as a whole. No one method should be used exclusively throughout the year. All of the suggested techniques should be considered and others explored.

One of the teacher's main responsibilities is to coordinate the activities of all groups in his class. Daily conferences between the teacher and his team are essential if each group is to have the benefit of planned instruction. Instead of preparing one lesson for the entire class, the teacher is responsible for planning material for each group in his room. Ideally, teachers in a self-pacing program will be provided planning periods for coordination of the team activities in addition to consultation with other members of the professional staff.

Continuous evaluation of student progress should be made. Regrouping within and between classes should be done as frequently as necessary on the basis of the evaluation. In general, no student should be a permanent member of any single group. Individuals should not be placed in groups on the basis of intelligence alone.

The first activity of a self-pacing program should be a diagnostic test. The students can then be assigned to the various sections on the basis of their background. Thus, all students in the program begin at different points.

In order to provide for maximum flexibility, at least two types of grouping should be utilized:

a) intra-class grouping, in which students are grouped within the same section under the same teacher.

b) inter-class grouping, in which students are re-assigned to different sections and teachers.

An important feature of intra-class grouping is the flexibility that it provides. In intra-class grouping, students are regrouped daily on the basis of their immediate needs. Intra-class grouping can be accomplished in a variety of ways.

One method provides the opportunity for some students to work independently using student assignment sheets for direction. The remainder of the class can be grouped on the basis of their performance on a drill given at the beginning of the period. The drill should contain material from the past several days' work. Students doing well on the drill can proceed to new material while those who need additional work can be directed to a review group. It is not necessary to record "grades" for these drills, since the drills should be diagnostic in nature.

A second method of daily grouping is to divide the class into two or more groups, depending upon their progress within a given unit.

A third method requires the student to indicate verbally the area in which he needs help. Students having similar difficulties can be grouped accordingly. These possibilities are not intended to be exhaustive.

Inter-class grouping is done less frequently. The basis of this type of grouping is the students performance on periodic evaluations by the professional staff. This evaluation is based on the judgement of the teacher and achievement on unit tests.

The exact technique of regrouping may take several forms. If only a few students in a given class complete the unit successfully, they can move on to the next higher section. Conversely, if only a few do not complete the unit successfully, they may either be re-assigned to a slower group within the class or to a slower section conducted by a different teacher.

The purpose of the achievement test is not to determine a student's grade on the unit. The function of this test is to determine whether the students' background is sufficient to insure success in subsequent units. The level of acceptable performance will vary from unit to unit depending upon the difficulty of the material and its relevance to future concepts. Acceptable scores should be determined for each test by the teaching staff before it is administered. Experience may revise the acceptance levels either upward or downward. A student receives either a "complete" or "incomplete" for the unit and never a numerical or letter grade.

If the student receives a grade of "complete", he moves on to the next unit. If a student's score is "incomplete", the teacher must diagnose the areas of difficulty and prescribe appropriate remedial action. The student may be instructed to restudy the entire unit or merely one or more topics in the unit. When he shows evidence of having completed this prescribed remedial program, he is retested. This retesting may take several forms. The student may take a retest on the entire unit. Therefore, several alternate forms of each unit test should be available. However, a student need not retake the entire test. The students may be tested only on those areas in which a lack of competence was indicated. This test may be written or oral. If the material still is not mastered adequately, the student is again recycled in the remedial process. A student is permitted to progress only when he has earned the grade of "complete". Since it very often happens that a student must restudy a unit several times, a variety of materials other than the text should be available. These should include additional texts, programmed materials, filmstrips, listening posts and recorders, overhead projectors, and remedial materials such as the SRA ALGEBRA KIT and MAST TEACHING.

The mobility of the students in a self-pacing program necessitates a different device for recording student progress than the traditional grade book. A more useful device is a student profile sheet where an entire page is devoted to each student. (See Appendix D.) When student transfers are made, the teachers exchange student profile sheets. The most valuable characteristic of these sheets is that they contain a complete record of the student's academic progress, attendance information, term grades, anecdotal records. They provide a more realistic basis for future placement than the traditional grade.

A sensible method of grading in a self-pacing program is to assign the higher grades to those students who have completed the greatest number of units, while lower grades would be assigned to students completing lesser numbers of units at the end of the term.

The above ideas for implementation of a self-pacing program are merely suggestive and are not intended to be mandatory or exhaustive. Continuous evaluation and refinement of this program can be best accomplished by the participating teachers. Your reactions and comments will prove invaluable for subsequent revision of this effort.

TOPICAL OUTLINE

FOR

A SELF-PACING PROGRAM IN ALGEBRA

VOLUME II

UNIT I

SYSTEMS OF LINEAR OPEN SENTENCES

TOPICAL OUTLINE

1. Solutions of equations in two variables.
2. Graphs of equations in two variables.
3. Slope of a line.
4. Point-slope form.
5. Slope-intercept form.
6. Solutions of two linear equations in two variables.
7. Determinants of 2 x 2 and 3 x 3 matrices.
8. Cramer's Rule for two equations in two variables and three equations in three variables.
9. Graph of a linear inequality in two variables.
10. Graph of the common solution of two linear inequalities.

UNIT II

POLYNOMIALS AND FACTORING

TOPICAL OUTLINE

1. Laws of positive integral exponents.
2. The zero exponent.
3. Products of polynomials.
4. Prime numbers and prime factorization of integers.
5. GCF and LCM of monomials.
6. Factoring polynomials.
7. Solution of open sentences by factoring.

*8. The solutions and graphs of quadratic inequalities.

9. Quotients of polynomials.

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* Optional

UNIT III RATIONAL NUMBERS AND EXPRESSIONS TOPICAL OUTLINE

1. Negative exponents.
2. Rational algebraic expressions and division by zero.
3. Reducing rational expressions to lowest terms.
4. Multiplication and division of rational algebraic expressions.
5. Addition and subtraction of rational algebraic expressions.
6. Simplification of complex fractions.
7. Open sentences involving fractions.
8. Fractional equations.

UNIT IV

RELATIONS AND FUNCTIONS

TOPICAL OUTLINE

1. Relations as sets of ordered pairs.
2. Domains and ranges of relations.
3. Functions defined by graphs and open sentences.
4. Ratio and proportion.
5. Linear functions.
6. Direct variation.
7. Concept of absolute value.
8. Solution of open sentences involving absolute value.
9. Graphs of absolute value functions.
10. Quadratic functions.
11. Completing the square.

UNIT V

REAL NUMBERS

TOPICAL OUTLINE

1. Graphs of $y = x^n$, $n = 1, 2, 3, 4\ldots$
2. n^{th} roots.
3. Simple radical expressions.
4. Rational numbers and their properties.
5. Irrational numbers and their properties.
6. Real numbers and their properties.
7. Rational exponents.
8. Properties of radicals.
9. Simplification of radicals.
10. Operations involving radicals.
11. Quadratic formula.
12. Relationship between the roots and coefficients of quadratic equations.
13. Radical equations.

1. The imaginary unit i.
2. Powers of i.
3. Writing numbers in the i-form.
4. Products and quotients of pure imaginary numbers.
5. Sums and differences of pure imaginary numbers.
6. The complex numbers.
7. Equality of complex numbers.
8. Additive inverses and conjugates of complex numbers.
9. Sums and differences of complex numbers.
10. Products and quotients of complex numbers.
11. The complex plane.
12. Geometrical addition and subtraction of complex numbers.
13. Solutions of quadratic equations over the complex numbers.
14. The discrimant $b^2 - 4ac$.
15. Nature of the roots of a quadratic equation.
16. The number of zeros of a quadratic function.

UNIT VII

LOGARITHMS

TOPICAL OUTLINE

1. Definition of a logarithm.
2. Approximations, precision, and accuracy.
3. Characteristic and mantissa of common logarithms.
4. Antilogarithms.
5. Interpolation.
6. Computation with logarithms.
7. Solving equations using logarithms.

UNIT VIII PROGRESSIONS AND THE BINOMIAL EXPANSION TOPICAL OUTLINE

1. Arithmetic progressions.
2. Arithmetic means.
3. Sums of arithmetic progressions.
4. Geometric progressions.
5. Geometric means.
6. Geometric series.
7. Infinite geometric series.
8. Pascal's triangle.
9. Powers of binomials.
10. General binomial expansion.
11. General term of the binomial expansion.
12. Factorial notation.

UNIT IX PERMUTATIONS; COMBINATIONS AND PROBABILITY TOPICAL OUTLINE

1. Counting principles.
2. Linear permutations.
3. Circular permutations.
4. Permutations of elements not all different.
5. Combinations.
6. Pascal's triangle.
7. Binomial theorem.
8. Events and sample spaces.
9. Probability.

UNIT X

QUADRATIC RELATIONS AND SYSTEMS

TOPICAL OUTLINE

1. Pythagorean theorem.
2. Distance formula.
3. Midpoint formula.
4. The circle.
5. The parabola.
6. The ellipse.
7. The hyperbola.
8. Solution of linear - quadratic systems by the graphical method.
9. Solution of linear - quadratic systems by the substitution method.
10. Solution of quadratic - quadratic systems by the substitution method.

UNIT XI MATRICES AND DETERMINANTS TOPICAL OUTLINE

1. Matrix terminology.
2. The zero matrix.
3. Transpose of a matrix.
4. Addition of matrices.
5. Scalar multiplication.
6. Matrix multiplication.
7. Determinants.
8. Inverses of 2 x 2 matrices.
9. Solutions of systems of linear equations by matrix methods.
10. Expansion of determinants by minors.

BEHAVIORAL OBJECTIVES

FOR

A SELF-PACING PROGRAM IN ALGEBRA

VOLUME II

UNIT I. Systems of Linear Open Sentences

The student should be able to:

1. identify the x-coordinate and y-coordinate of an ordered pair.
2. given an ordered pair, identify the point in the plane to which it corresponds.
3. given a point in the plane, identify it by stating its coordinates.
4. given an ordered pair, name the quadrant or axis in which its graph lies.
5. state that there is a one-to-one correspondence between the set of points in the plane and the set of ordered pairs of real numbers.
6. given a set of ordered pairs, determine which ordered pairs satisfy a given linear equation in two variables.
7. identify the quadrants by number, the x and y axes by name, and the abscissa and ordinate of a given ordered pair.
8. distinguish between a linear equation and such non-linear equations as $y = x^2$ and $xy = 5$.
9. name the general form of a linear equation, $ax + by + c = 0$.
10. given a specific linear equation, identify the numbers represented by a, b, and c in the general form.
11. given a linear equation, solve for y in terms of x.
12. construct a suitable table of values and the graph of a given linear equation with integral coefficients, including cases where a or b is zero.
13. state that the x and y - intercepts are numbers.
14. define slope as either (1) $\frac{\text{rise}}{\text{run}}$ (2) $\frac{\Delta y}{\Delta x}$ or (3) $\frac{y_2 - y_1}{x_2 - x_1}$
15. calculate the slope of a segment given the coordinates of its endpoints.
16. state that the letter "m" is the standard abbreviation for slope.
17. given a line with two identifiable points in the Cartesian plane, calculate its slope.
18. state that the slope of a line does not depend upon the particular pair of points on the line used to calculate it.

19. determine whether or not three given points are collinear by calculation of slopes.

20. name $y = mx + b$ as the slope-intercept form of the linear equation.

21. give the slope of a line, given its equation in the form $y = mx + b$.

22. state the y-intercept of a line, given its equation in the form $y = mx + b$.

23. calculate the slope of a line given its equation in the form $ax + by + c = 0$ by transforming this to the form $y = mx + b$.

24. name $y - y_1 = m (x - x_1)$ as the point-slope form of a linear equation.

25. given the slope of a line and a point on the line, find the equation in point-slope form, and in $ax + by + c = 0$ form.

26. given any two points on a line, determine its equation writing the result in standard form $ax + by + c = 0$.

27. given two equations, determine by slope calculation whether or not the given lines are parallel.

28. calculate the x and y - intercepts of a line defined by an equation of the form $ax + by + c = 0$.

29. determine the common solution to a system of two linear equations in two variables by the graphical method. (The solution should be an ordered pair of integers.)

30. given a set of consistent equations with integral coefficients, find the common solution by either the addition - subtraction method or substitution, whichever is more convenient.

31. state that a determinant is a number.

32. given a 2 x 2 determinant, calculate its value.

33. apply Cramer's Rule to obtain the solution of a system of two consistent linear equations in two variables.

34. evaluate a third order determinant.

35. apply Cramer's Rule to obtain the solution of a system of three consistent linear equations in three variables (or to "set-up" solutions, but not evaluate the determinants).

36. draw the graph of a linear inequality in two variables.

37. construct graphically the common solution of two linear inequalities in two variables.

UNIT II. Polynomials and Factoring

The student should be able to:

1. state the basic laws of exponents in words and symbols:

   a. $a^m \cdot a^n = a^{m+n}$ where m and n are positive integers.

   b. $(a^m)^n = a^{mn}$ where m and n are positive integers.

   c. $a^m \div a^n = a^{m-n}$ where m and n are positive integers.

   d. $a^m \div a^n = \frac{1}{a^{m-n}}$ where m and n are positive integers with $m < n$.

   e. $(ab)^m = a^m b^m$ where m is a positive integer.

2. state the definition for a^0.

3. find the products, quotients, and powers of monomials by a one-step application of laws 1a-e.

4. determine products, quotients, and powers of monomials by a one-step application of two or more of the laws 1 a-e.

5. find the product, quotient, or power of real numbers with variable exponents.

   e.g. $a^{x+1} \div a^x$

6. completely simplify polynomial expressions whose terms are powers, products, and quotients of real numbers.

   e.g. $(-3b)^3 (6b^2) - (2b)^4 \div (2b^2)$

7. state the distributive law $a(b + c) = ab + ac$ and $(b + c)a = ba + ca$.

8. calculate the product of a monomial and polynomial by use of the distributive law.

   e.g. $7(x + 3)$ $(x + 2y)6y$

9. calculate the product of any two binomials using the FOIL method.

10. multiply any two polynomials.

11. state the identity $(a + b)^2 = a^2 + 2ab + b^2$.

12. apply the identity in 11 to square a binomial.

13. state the identity $(a + b)(a - b) = a^2 - b^2$.

14. apply the identity in 13 to find the product of the sum and difference of two numbers.

15. distinguish between prime and composite numbers.

16. find all the integral factors of an integer.

17. factor an integer over the set of prime integers.

18. determine the GCF of two or more integers.

19. determine the LCM of two or more integers.

20. express a monomial (such as $6x^3$) as the product of prime polynomial factors.

21. calculate the GCF and LCM of two or more monomials with integral coefficients.

22. given a set of polynomials, identify those whose terms contain a common monomial factor (other than 1).

23. given a polynomial, state the GCF of its terms.

24. factor a polynomial by removing the greatest common monomial factor.

25. given a set of polynomials, identify those which are the difference of two squares.

26. state the identity $a^2 - b^2 = (a + b)(a - b)$.

27. factor a polynomial which is the difference of two squares.

28. given a set of trinomials, identify those which are squares of binomials.

29. state the identity $a^2 \pm 2ab + b^2 = (a \pm b)^2$.

30. factor a trinomial which is a square of a binomial.

31. given a set of polynomials, identify quadratic trinomials.

32. factor a quadratic trinomial of the form $ax^2 + bx + c$.

33. given a set of polynomials, identify those which are the sum or difference of two cubes.

34. state the identity $a^3 \pm b^3 = (a \pm b) \quad (a^2 \pm ab + b^2)$.

35. factor a polynomial which is the sum or difference of two cubes.

36. given a set of polynomials, identify those which:
    a. have a common monomial factor.
    b. are the difference of two squares.
    c. are the squares of binomials.
    d. are the sum and difference of two cubes.
37 given a polynomial of four terms, rearrange and group the terms for the purpose of factoring.
38. factor a polynomial completely by use of two or more factoring methods.
39. state the rule that if the product of two or more numbers is zero, at least one of the numbers must be zero.
40. solve a quadratic equation with integral coefficients by factoring.
*41. use factoring to solve quadratic inequalities.
*42. graph the solution set of quadratic inequalities.
43. use the distributive law to express the quotient of a polynomial by a monomial as the sum of fractions.
44. find the quotient of a polynomial divided by a polynomial.

UNIT III. Rational Numbers and Expressions

The student should be able to:

1. state the definition $b^{-n} = \frac{1}{b^n}$ where n is a positive integer.

2. apply the definition in 1 for one-step simplification of problems such as $\frac{1}{b^{-4}}$ and $(\frac{1}{a})^{-1}$

3. using two or three simplification procedures, write expressions involving negative exponents with positive exponents only. For example:

   a. $3x^{-2}$
   b. $\frac{r^2}{t^{-3}}$
   c. x^2y^{-3}
   d. $5a^{-2}b^{-3}$
   e. $\frac{6x^2y^{-3}}{d^{-4}}$

4. state that the laws of exponents hold for negative as well as positive integral exponents.

5. use the laws of exponents to simplify expressions involving negative exponents such as:

   a. $(a^3)^{-2}$
   b. $(\frac{1}{t^{-4}})^{-2}$
   c. $\frac{a^{3t-2}}{a^{-t+2}}$
   d. $(b^{-4})^{-2}$

6. state the definition of a rational number.

7. state whether or not a given number is rational.

8. given a set of expressions; identify those which are rational.

9. state that division by zero is not defined.

10. express a given rational number as a decimal.

11. express a repeating or terminating decimal as the ratio of two appropriate integers.

12. write an expression such as $.\overline{23}$ in the form .232323...

13. round off a decimal to any stated number of places (using the "round upwards on 5's" rule).

14. determine values of the variable in a given rational algebraic expression for which the value of the expression is undefined.

15. use the property of fractions to reduce rational expressions to lowest terms.

16. apply the definition of multiplication of fractions to find the product of two rational expressions, expressing the product in simplest form.

17. apply the definition of division of fractions to find the quotient of two rational expressions, expressing this result in simplest form.

18. determine the sum of two fractions with equal denominators, expressing the sum in simplest form.

19. find the LCM of two or more polynomials.

20. determine the sum of two fractions with unequal denominators, expressing the sum in simplest form.

21. simplify complex fractions using either the product method or division method, whichever is more convenient.

22. determine the solution set of an equation or system of linear equations whose terms involve fractions.

23. solve fractional equations, checking for extraneous roots.

UNIT IV. Relations and Functions

The student should be able to:

1. define a relation as a set of ordered pairs.
2. define a function as a set of ordered pairs whose first coordinates are different.
3. distinguish between a function and relation which is not a function given several sets of ordered pairs.
4. given a relation, determine its domain and its range.
5. state whether or not a given graph defines a function or just a relation.
6. determine the domain and range of a given function or relation defined by a graph.
7. given an open sentence defining a function such as $y = \frac{1}{x^2 - 4}$,

   determine the domain of the function using the agreement that, unless otherwise stated, the domain of a function is the "largest" subset of the real numbers for which the rule makes sense.
8. given a relation or function defined by a finite set of ordered pairs, construct its graph.
9. given a linear function defined by a rule, such as $y = mx + b$ or $ax + by + c = 0$, $b \neq 0$, whose domain may be a subset of of the reals, construct the graph of the function. For example:

   Graph $f = \{ (x, y) \mid y = 3x - 2, -2 < x \leq 0 \}$
10. state that a function can be defined by any of the following:
    - a. a table of values.
    - b. a set of ordered pairs.
    - c. a graph.
    - d. a rule.
11. given a function defined in any manner, determine the value of a function at a given number in the domain of the function.
12. given a function defined by a rule such as $f(x) = 3x - 2$, state that "f(2)" means "the value of the function at 2" and can be read "f at 2" or "f of 2".
13. given any two linear functions defined by rule, for example, $f(x) = 2x + 1$ and $g(x) = 3x - 2$, determine by computation $f(g(2))$ and $g(f(2))$.

14. given a suitable table of values defining a linear relation between two variables, write an open sentence for one variable in terms of the other.

15. state that some lines define functions and some do not.

16. given a set of open sentences in two variables, identify those whose graphs are lines.

17. state that $\{(x, y) \mid y = 3\}$ is an example of a constant function.

18. state that $\{(x, y) \mid y = 3x + 2\}$ is an example of a linear function or polynomial function of degree one.

19. determine the absolute value of a given number.

20. state that the absolute value of a number represents the distance from the origin to the point whose coordinate is that number.

21. solve open sentences involving absolute value such as the following:

    a. $|x| = 4$
    b. $|x - 2| = 3$
    c. $|x + 5| = -1$
    d. $|2x + 1| = 7$
    e. $3|x-2| = 15$
    f. $|x| < 5$
    g. $|x| \geq 3$
    h. $|2x - 1| \leq 5$

22. graph special functions defined by rules involving absolute value such as:

    a. $y = |x|$
    b. $y = 2|x|$
    c. $y = |x - 1|$
    d. $y = -2|x + 1|$

23. graph piecewise defined linear functions such as:

$$y = \begin{cases} 2x, & x < 0 \\ 3x + 1, & x \geq 0 \end{cases}$$

24. state that a linear function defined by rules such as $y = 3x$ (i.e. $y = mx$ in general) is called a direct variation with constant of proportionality m.

25. state that the graph of a direct variation always passes through the origin of the coordinate axes system.

26. state that a ratio is the quotient of two numbers.

27. determine the ratio (expressed in simplest form) of two given quantities of similar or dissimilar dimensions. For example, "determine the ratio of 3 inches to 6 feet".

28. define a proportion as the equality of two ratios.

29. given a proportion, identify the means and extremes, as well as the first, second, third, and fourth terms.

30. state that in a proportion the product of the means always equals the product of the extremes (the proportion property).

31. use the proportion property to solve given proportions.

32. given a statement such as "the perimeter P of a square varies directly as the length of a side, s", write a formula for the direct variation.

33. given a table of values, determine whether or not it defines a direct variation and, if so, write a formula for the variation.

34. name a function defined by an open sentence such as:

$$y = ax^2 + bx + c \text{ , } a \neq 0$$

as a quadratic function or polynomial function of degree two.

35. given the special case of the quadratic function defined by $y = 3x^2$:

    a. construct a graph.

    b. name the curve as a parabola.

    c. state that the y-axis is the axis of symmetry.

    d. given a point on the graph of the function, find its symmetric point with respect to the y-axis.

    e. state that the origin is the vertex of the parabola.

36. state how the graph of the parabola defined by $y = ax^2$ is affected by the value of a.

37. state that the vertex is the maximum point if $a < 0$ and a minimum point if $a > 0$.

38. graph the quadratic functions defined by $y = ax^2 + c$ for different values of c and state the effect of c upon the graph of the function.

39. graph the quadratic function defined by $y = (x - h)^2$ for different values of h and state the effect of h upon the graph of the quadratic function.

40. state that the graph of the function defined by $y = a(x - h)^2 + k$, $a \neq 0$, is a parabola with:

    a. $x = h$ as the axis of symmetry.

    b. vertex (h, k).

    d. (h, k) as a maximum point if $a < 0$ and a minimum point if $a > 0$.

41. given a quadratic function defined by $y = -2(x-3)^2 + 5$,

   a. write the equation of the axis of symmetry.

   b. write the coordinates of the vertex.

   c. state whether the vertex is a maximum or minimum point.

   d. give the maximum or minimum value of the function.

42. given an expression in the form $x^2 + bx$, determine what number must be added to it to make the result the square of a binomial.

43. given a quadratic function defined by $y = ax^2 + bx + c$, transform it into the form $y = a(x - h)^2 + k$.

44. state that the graph of any quadratic function is a parabola.

UNIT V. Real Numbers

The student should be able to:

1. draw graphs for $y = x^n$, $n = 1, 2, 3, 4 \ldots$
2. state which curves of the family $y = x^n$ are symmetric with respect to the y-axis and which are symmetric with respect to the origin, as well as those which have minimum values.
3. define a square root of b as any number x such that $x^2 = b$.
4. generalizing (3), define an n^{th} root of b as any number x such that $x^n = b$.
5. discuss the number and the nature of the n^{th} roots (real) of a number b:
   - a. if n is even and b is negative, there is no real n^{th} root of b.
   - b. if n is even and b is 0, there is one real n^{th} root of b, namely 0.
   - c. if n is even and b is greater than 0, there is one positive n^{th} root of b and one negative n^{th} root of b, equal in absolute value.
   - d. if n is odd and b is negative, there is one and only one n^{th} root of b (a negative number).
   - e. if n is odd and b is 0, there is one and only one n^{th} root of b, namely 0.
   - f. if n is odd and b is positive, there is one and only one n^{th} root of b (a positive number).
6. state that an expression such as $\sqrt[7]{8}$ is a real number x such that $x^7 = 8$.
7. define " $\sqrt[n]{b}$ " as a number x such that $x^n = b$ with the standard agreement that $\sqrt[n]{b}$ is a positive number in the case where n is even and b is positive.

8. use the definition of $\sqrt[n]{b}$ to simplify expressions such as:

a. $\sqrt{100}$

b. $\sqrt[3]{-8}$

c. $\sqrt[5]{32}$

d. $\sqrt[4]{0}$

e. $\sqrt[10]{1}$

f. $\sqrt[8]{256}$

g. $\sqrt{\frac{4}{9}}$

h. $\sqrt[5]{-\frac{1}{243}}$

i. $\sqrt[3]{\frac{1}{64}}$

9. given a list of radical expressions, such as:

a. $\sqrt[6]{-32}$

b. $\sqrt[7]{-56}$

c. $\sqrt[3]{16}$

d. $\sqrt{-1}$

identify those which name real numbers.

10. identify the radicand and index of a radical expression.

11. use the definition of $\sqrt[n]{b}$ to make one-step simplifications for such radical expressions as:

a. $\sqrt[2]{5^2}$

b. $\sqrt[3]{4^3}$

c. $(\sqrt{2})^2$

12. state conditions on n or b such that expressions such as:

a. $\sqrt[n]{2}$

b. $\sqrt[n]{-4}$

c. $\sqrt[3]{b}$

d. $\sqrt{b}$

define real numbers.

13. use the identities $\sqrt[n]{x^n} = |x|$ if n is even, and $\sqrt[n]{x^n} = x$ if n is odd to simplify radical expressions such as:

a. $\sqrt[4]{(-5)^4}$

b. $\sqrt[5]{(5)^5}$

c. $\sqrt[3]{(-3)^3}$

d. $\sqrt[15]{(-3)^{15}}$

e. $\sqrt[16]{(-2)^{16}}$

14. solve simple polynomial equations such as:

    a. $2x^2 = 8$ b. $3x^5 + 1 = 0$

    solving x^2 and x^5 by applying the identities in (12), and solving the resulting absolute value equation.

15. use a table of roots to find square and cube roots of given numbers.

16. state that the rational numbers are closed under the four basic operations (division by zero excluded).

17. given a rational number in one of the forms:

    .3333... .232323... .341414...

    find an expression for it as the quotient of two integers.

18. given two rational numbers, find a third number which is strictly between them by averaging.

19. state the property of density for the set of rational numbers.

20. summarize the pertinent facts about rational numbers with regard to decimal representation:

    a. every rational number can be written as a finite decimal or infinite periodic decimal.

    b. every finite decimal or infinite periodic decimal names a rational number.

21. define irrational numbers as numbers that are not rational.

22. use the theorem on the possible rational roots of polynomial equations and an indirect argument to prove that numbers such as:

    a. $\sqrt{2}$ c. $-\sqrt{5}$

    b. $\sqrt[3]{3}$

    are irrational.

23. use indirect arguments to prove that numbers such as $2 + \sqrt{3}$ are irrational, assuming that $\sqrt{3}$ is irrational.

24. state that all irrational numbers have decimal representations that are infinite but non-periodic.

25. write a number in decimal form not representing a rational number.

26. state the following conclusions about the interplay of the rationals and irrationals such as:

  a. rational numbers are closed under addition.

  b. the sum of an irrational number and a rational number is always irrational.

  c. the sum of two irrational numbers may be either rational or irrational.

  d. the product of an irrational number and non-zero rational number is always irrational.

  e. the product of two irrational numbers may be rational or irrational.

27. define the set of real numbers as the set of all numbers named by decimals, finite or infinite.

28. state the property of density for real numbers.

29. draw a Venn diagram of the real number system.

30. identify $3^{\frac{1}{2}}$ with $\sqrt{3}$ and $a^{\frac{1}{2}}$ with $\sqrt{a}$, $a > 0$, in general.

31. define $b^{\frac{1}{r}}$ as $\sqrt[r]{b}$ where r is a positive integer and b ia a non-negative real number.

32. define $b^{\frac{p}{r}}$ as $(\sqrt[r]{b})^p$ where r is a positive integer, p is integral, and b is a non-negative real number.

33. using the definition of rational exponents, evaluate such numerical expressions as:

  a. $64^{\frac{2}{3}}$ b. $(125)^{\frac{-4}{3}}$

34. simplify expression such as $\sqrt[12]{25}$ by reduction of index.

35. assuming positive variables, write expressions of the following types in exponential form with all positive exponents:

  a. $\sqrt{3x}$ c. $\sqrt[3]{84a^5b^6}$

  b. $\sqrt{9a^{-1}b^8}$

36. assuming positive variables, write the following expressions in radical form, using positive exponents and one radical sign:

a. $5^{\frac{1}{2}}$

b. $6^{\frac{1}{3}}$

c. $7^{\frac{3}{4}}$

d. $3a^{\frac{2}{3}}$

e. $7^{\frac{1}{3}} b^{\frac{1}{6}} c^{-\frac{2}{3}}$

37. simplify by reducing the number of radical signs in such expressions as:

a. $\sqrt[3]{\sqrt{27}}$

b. $\sqrt{\sqrt[3]{36}}$

38. use rational exponents with the accepted exponential laws to find solutions to exercises of the following types, writing answers in simplest radical form with one radical sign:

a. $\sqrt[3]{2^5} \times \sqrt[4]{2}$

b. $\sqrt[6]{32} \div \sqrt[3]{2}$

39. solve such equations as:

a. $b^{\frac{1}{5}} = 2$

b. $b^{\frac{2}{3}} = 8$

c. $b^{\frac{-4}{3}} = 16$

40. use the product and quotient properties of radicals assuming all variables are positive to simplify expressions such as:

a. $\sqrt{12}$

b. $\sqrt[3]{32x^3y^4}$

c. $\sqrt{24x}$

d. $\dfrac{6}{\sqrt{2}}$

e. $\dfrac{\sqrt{7}}{\sqrt{2}}$

f. $\sqrt{\dfrac{8v^{-1}}{9}}$

g. $\sqrt[3]{\dfrac{1}{54r^5}}$

h. $(\frac{1}{5}\sqrt{5a})(\sqrt{2})$

i. $\sqrt{16x^3} \times \sqrt{32x^4}$

j. $\sqrt[5]{a^6b^5}$

k. $\sqrt[7]{a^{-3}}$

l. $\sqrt[3]{\frac{-1}{54}}$

m. $\dfrac{5\sqrt{50y}}{15\sqrt{5y^3}}$

41. distinguish between similar and dissimilar radicals.

42. use the distributive property to combine radicals with the same index and radicand. For example:

a. $3\sqrt{x} + 3\sqrt[3]{x} + 5\sqrt{x}$

b. $\sqrt[3]{5} + \sqrt[4]{5} - 7\sqrt[3]{5}$

c. $\sqrt{50} - 7\sqrt{2}$

d. $a\sqrt{12a^2} + 7\sqrt{2}\,a^2 - \sqrt{24a^4}$, where $a > 0$

43. use the distributive property to find products of sums whose terms involve radicals. For example:

$(5 + \sqrt{3})(\sqrt{2} - \sqrt{3})$

44. find quotients by rationalization of denominators for such problems as:

a. $\dfrac{5}{1 + \sqrt{2}}$ b. $\dfrac{2 + \sqrt{3}}{2 - \sqrt{3}}$

45. define $ax^2 + bx + c$, $a \neq 0$, as the general quadratic equation in standard form.

46. given a quadratic equation, write it in standard form.

47. for a specific given quadratic equation, identify a, b, and c.

48. identify all quadratic equations in a set of given equations.

49. solve quadratic equations with integral coefficients by completing the square.

50. assuming $b^2 - 4ac > 0$, develop the quadratic formula.

51. state the quadratic formula.

52. solve quadratic equations with real solutions and integral coefficients using the quadratic formula, writing solutions in:

    a. simplest radical form.

    b. decimal approximation to nearest tenth or hundredth using a given table of roots.

53. give the product and sum of the roots of a quadratic equation with integral coefficients.

54. given two integers, find a quadratic equation with those numbers as roots.

55. distinguish between an equation containing radicals and a radical equation.

56. find solutions of radical equations of the following types:

    a. $\sqrt{m} = 8$

    b. $\sqrt{d} - 6 = 0$

    c. $\sqrt{5x + 1} = 4$

    d. $\sqrt{x - 5} = x - 7$

UNIT VI. Complex Numbers

NOTE: The number i can be introduced in a variety of acceptable ways. These include:

a. the vector approach,

b. the solution of $x^2 + 1 = 0$, and

c. the operator approach in which i rotates the unit segment 90° counter-clockwise.

The student should be able to:

1. define the number i.

2. use the property that $i^2 = -1$ to reduce any power of i to one of the numbers 1, -1, i, -i.

3. given a set of numbers, identify the pure imaginary numbers.

4. write numbers such as $\sqrt{-8}$ in i form.

5. make a distinction between a correct application of the product property of radicals and an incorrect one. For example which argument is valid:

$$\sqrt{-8}\ \sqrt{-2} = \sqrt{(-8)(-2)} = \sqrt{16} = 4$$

$$\sqrt{-8}\ \sqrt{-2} = (\sqrt{8}\,i)(\sqrt{2}\,i) = i^2\sqrt{(8)(2)} = -1\sqrt{16} = -4$$

6. multiply and divide real and imaginary numbers given in either i form or $\sqrt{-1}$ form. Examples are:

a. $(2i)(3i)$

b. $\sqrt{-8} \times \sqrt{-2}$

c. $\frac{5}{4i}$

d. $\frac{12}{2i^3}$

7. solve equations with two pure imaginary roots such as $3x^2 + 6 = 0$.

8. add and subtract two or more pure imaginary numbers, writing answers in the i-form. Examples are:

a. $\sqrt{-16} + \sqrt{-49}$

b. $5\sqrt{-48} - \sqrt{-27}$

9. define the complex numbers as the set of all numbers of the form $a + bi$, where a and b are real numbers.

10. state that both the real numbers and the pure imaginary numbers are subsets of the complex number system.

11. plot given complex numbers on the complex plane.

12. state whether or not two given complex numbers are equal.

13. use the definition of equality of complex numbers to solve for a and b in an equation such as:

    $a + bi = 3 - 2i$

14. find the sum of two or more given complex numbers.

15. illustrate the addition of complex numbers in the complex plane using the "head to tail" geometric method.

16. state additive inverses of given complex numbers.

17. find the difference of two given complex numbers by applying the definition of subtraction and geometrically.

18. state the additive and multiplicative identity elements for the set of complex numbers.

19. given any complex number, write its complex conjugate.

20. find products and quotients of complex numbers, writing solutions in standard form $a + bi$.

21. determine multiplicative inverses of given complex numbers.

22. state that the complex numbers are closed under the four basic operations (division by zero excepted).

23. state that the trichotomy principle does not hold for complex numbers.

24. draw a Venn diagram of the complex number system.

25. solve quadratic equations with integral coefficients (whose roots may be complex) using the quadratic formula.

26. determine the discriminant $b^2 - 4ac$ of a given quadratic equation.

27. given a quadratic equation with integral coefficients, discuss the nature of the roots by analyzing the discriminant.

UNIT VII. Logarithms

The student should be able to:

1. define a logarithm as an exponent.
2. state which numbers are excluded as bases for systems of logarithms.
3. write a given exponential statement in logarithmic form.
4. given a logarithmic statement, write its equivalent exponential statement.
5. given a real number, state whether or not it has a logarithm.
6. given any measurement, write its greatest possible error.
7. given any measurement, write its precision.
8. given any measurement, write its accuracy.
9. given any measurement, state the number of significant digits in the measurement.
10. given a number, express it in scientific notation (standard notation).
11. given a number in standard notation, write it in decimal form.
12. given two numbers written in standard notation, tell which is the greater.
13. find one significant digit estimates to such problems as:
    a. $(128.2) \times (.036)$
    b. $\frac{(538.2) \times (36.24)}{528.3}$
14. use the laws of exponents to perform the indicated operations on problems involving scientific notation such as:

$$\frac{(4 \times 10^{8})(5 \times 10^{-3})}{8 \times 10^{3}}$$

15. given a logarithm, identify the characteristic and mantissa.

16. using given tables, write logarithms of specific numbers.

17. using a table, find the antilogs of given numbers.

18. given a number whose logarithm is not listed in a table, estimate the logarithm by interpolation.

19. given a logarithm not listed in a given table, determine its approximate antilogarithm by interpolation.

20. state the identities:

$$\log ab = \log a + \log b$$

$$\log \frac{a}{b} = \log a - \log b$$

21. use the identities:

$$\log ab = \log a + \log b$$

$$\log \frac{a}{b} = \log a - \log b$$

22. state the identity $\log a^n = n \log a$.

23. use the identity $\log a^n = n \log a$.

24. apply logarithms to solve problems containing several operations.

25. use logarithms to solve equations such as:

a. $x^{\frac{3}{5}} = 2.32$

b. $2^x = 14$

c. $10^{3x-1} = 5.12$

UNIT VIII. Progressions and the Binomial Expansion

The student should be able to:

1. recognize an arithmetic progression.
2. write a term of an arithmetic progression, given the preceding ones.
3. given an arithmetic progression, state the common difference.
4. given the first term of an arithmetic progression and common difference, write the progression.
5. write the formula for the n^{th} term of an arithmetic progression.
6. use the formula for the n^{th} term of an arithmetic progression to determine any term, given the first term and common difference.
7. insert any number of arithmetic means.
8. write the formula for the sum of the first n terms of an arithmetic progression,

$$s_n = \frac{n(a + l)}{2} \quad \text{or} \quad s_n = \frac{n}{2}\left[2a + (n-1)\,d\right]$$

9. given an arithmetic progression, find the sum of any number of terms.
10. given an expression in summation notation such as $\sum_{i=1}^{5} i^2$, write it in expanded form.
11. identify a geometric progression.
12. given a geometric progression, write the common ratio.
13. given the first term and common ratio of a geometric progression, write any number of terms.
14. write the formula for the n^{th} term of a given geometric progression to determine any term, given the first term & common ratio.
15. determine by calculation the mean proportional to two real numbers.
16. insert any number of geometric means between any two real numbers.
17. given a geometric progression, write the corresponding geometric series.

18. write the formula for the sum of the first n terms of a geometric series given the first term and common ratio

$$s_n = \frac{a(1-r^n)}{1-r},\ r \neq 1 \text{ or } s_n = \frac{a - rl}{1-r},\ r \neq 1$$

given a geometric progression, find the sum of any number of terms.

19. given an infinite geometric series, state whether or not it has a sum.

20. using the formula $s = \frac{a}{1-r}$, determine the sum of an infinite geometric series, with $|r| < 1$.

21. write a periodic decimal such as .333... or .999... as an infinite geometric series.

22. given a periodic decimal such as .999..., find the sum of the associated geometric series by using the formula.

23. write the first six rows of Pascal's triangle.

24. use Pascal's triangle to write the expansion of $(a + b)^n$ for n = 2, 3, 4, or 5.

25. write the general expansion for $(a + b)^n$ in the form:

$$(a + b)^n = a^n + \frac{na^{n-1}b}{1} + \frac{(n)(n-1)\,a^{n-2}b^2}{1 \times 2} +$$

$$\frac{(n)(n-1)(n-2)a^{n-3}b^3}{1 \times 2 \times 3} + \ldots + b^n$$

26. using the binomial formula, expand any binomial such as $(x + y)^5$ or $(2m - n)^4$.

27. write a formula for the r^{th} term of $(a + b)^n$.

28. apply the formula in (25) to specific examples.

29. expand any number written in factorial notation such as 5!

30. state that 0! = 1 and 1! = 1.

31. simplify expressions involving factorial notation such as:

a. 3! 2!

b. (3 x 2)!

c. $\frac{5!}{3!}$

d. $\frac{6!}{4!\,2!}$

UNIT IX. Permutations, Combinations, and Probability

The student should be able to:

1. given any two finite sets, determine the cross product of the sets.
2. given two finite sets, determine the number of elements in the cross product without writing the set.
3. determine the number of members in the union of two finite sets using the property $n(A \cup B) = n(A) + n(B) - n(A \cap B)$.
4. state the fundamental counting principle: if act A can be performed in X_A ways and act B can be performed in X_B ways then act A followed by act B can be done in $X_A X_B$ ways.
5. use the fundamental counting principle to solve such standard problems as telephone number problems, car license problems, and digit problems.
6. state that a permutation of a set is any arrangement of the members of the set in a definite order.
7. translate expressions such as ${}_5P_5$ as the number of permutations of the members of a set with 5 elements.
8. state the formula ${}_nP_n = n!$
9. write the formula for the number of permutations of n objects taken r at a time

$${}_nP_r = (n)(n-1)(n-2)\ldots(n - r + 1) = \frac{n!}{(n - r)!}$$

10. solve simple arrangement problems using the formula in 8.
11. calculate the number of circular permutations of the members of a given set.
12. determine the number of distinguishable permutations of objects that are not all different.
13. solve standard problems involving permutations of objects not all different.
14. given a set of n elements, determine the number of different subsets containing r elements.
15. recognize that the symbol ${}_5C_3$ is the number of combinations of 5 things taken three at a time.

16. write the formula $_nC_r = \frac{n!}{r!\,(n-r)!} = \frac{_nP_r}{r!}$

17. use the combination formula to solve basic problems involving one or more sets.

18. write the binomial expansion using combination notation

$$(a + b)^n = {_nC_0}a^n + {_nC_1}a^{n-1}b + {_nC_2}a^{n-2}b^2 + \ldots + {_nC_n}b^n$$

19. use Pascal's triangle to evaluate $_nC_r$.

20. write sample spaces for certain experiments such as rolling a die followed by flipping a coin.

21. determine the probability of a given event in a sample space.

22. state that probabilities are real numbers between 0 and 1, inclusive.

23. state the meanings of probabilities of 0 and 1.

24. given a simple event, write its complementary event.

25. given the probability of an event, write the probability of the complementary event.

26. given the probability of an event, state the odds for the event.

27. given the odds of an event, state the probability of the event.

28. given two events state whether or not they are mutually exclusive.

29. state that if two events are mutually exclusive, they have no outcome in common.

30. state that for two events which are mutually exclusive we have:

$$P(A \cup B) = P(A) + P(B)$$

31. state whether or not two events are dependent or independent.

32. write the formula that for independent events

$$P(A \cap B) = P(A) \times P(B)$$

33. write the formula for the probability of two events which are dependent

$$P(A \cap B) = P(A) \times P(B|A)$$

UNIT X. Quadratic Relations and Systems

The student should be able to:

1. use the Pythagorean theorem to calculate the length of any side given the other two sides of a triangle.
2. use the distance formula to calculate the length of any segment whose endpoints are known.
3. given the endpoints calculate the coordinates of the midpoint of a segment.
4. determine whether or not three given points are collinear.
5. define a circle as the set of all points equidistant from a given fixed point.
6. given any point as center and any positive number as radius, write the equation of the circle in standard form:

   $$(x - h)^2 + (y - k)^2 = r^2$$

   or general form:

   $$x^2 + y^2 + Dx + Ey + F = 0$$

7. given an equation of the form:

   $$x^2 + y^2 + Dx + Ey + F = 0$$

   transform it to standard form:

   $$(x - h)^2 + (y - k)^2 = r^2,$$

   name the center and radius and graph the circle.

8. given a set of equations, identify those which define circles.
9. graph subsets of the plane defined by such open sentences as:
   - a. $x^2 + (y - 2)^2 \leq 9$
   - b. $(x - 4)^2 + (y + 2)^2 > 1$
10. given a fixed point as focus on the x-axis (y-axis) and a fixed vertical (horizontal) line as directrix, determine the equation of the parabola using the distance formula.
11. given a set of equations, identify those which define parabolas.

12. given an equation in the form:

$$y = ax^2 + bx + c$$

transform it to the form:

$$y = A(x - h)^2 + B,$$

and then identify the axis, vertex, direction of concavity, and coordinates of the maximum or minimum point of the parabola.

13. given two points on the x (or y) axis equidistant from the origin and given the sum of the lengths of the focal radii, calculate the equation of the ellipse by use of the distance formula.

14. given an equation in one of the forms:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

or:

$$\frac{y^2}{a^2} + \frac{x^2}{b^2} = 1$$

identify the x and y intercepts, and sketch the ellipse.

15. given an equation in the form $Ax^2 + By^2 + C = 0$, $A > 0$, $B > 0$, and $C < 0$, transform it to standard form:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1,$$

and conversely.

16. given a set of equations, identify those which define ellipses.

17. graph subsets of the plane defined by such open sentences as:

a. $x^2 + 4y^2 < 16$

b. $x^2 + 16y^2 \geq 64$

18. given two points on the x (or y) axis equidistant from the origin and the absolute value of the difference of the focal radii, calculate the equation of the hyperbola using the distance formula.

19. given an equation of the form:

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

or:

$$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1,$$

graph the hyperbola by construction of the basic rectangle, asymptotes, and plotting several points.

20. given an equation of the form $Ax^2 + By^2 + C = 0$ where A and B have opposite signs, transform the equation to one of the basic forms and graph the hyperbola.

21. given a set of equations identify those which define hyperbolas.

22. state that the circle, ellipse, parabola, and hyperbola are called conic sections.

23. given a linear-quadratic system of equations in two variables, determine all common solutions by the substitution method.

24. state that a linear-quadratic system of equations in two variables can have zero, one, or two distinct real solutions.

25. given a quadratic-quadratic system of equations in two variables, find all common solutions by the substitution method.

26. state that a system of two quadratic equations in two variables can have zero, one, two, three, or four distinct real solution.

27. draw diagrams of two stated conic sections intersecting in a given number of distinct points.

UNIT XI. Matrices and Determinants

The student should be able to:

1. state that a matrix is a rectangular array.
2. given a matrix, state its dimensions.
3. given a matrix, identify its rows and its columns.
4. given a matrix, name the element in a given position.
5. given a matrix, write its transpose.
6. write the zero matrix of given dimensions.
7. add two conformable matrices.
8. state that the closure property and commutative and associative laws hold for addition of conformable matrices.
9. given a matrix, write its additive inverse.
10. subtract two conformable matrices.
11. multiply a matrix by a scalar.
12. simplify linear combinations of matrices and scalars such as:

    $$3 \begin{bmatrix} 1 & 2 \\ 0 & -3 \end{bmatrix} + 2 \begin{bmatrix} 0 & 4 \\ -2 & 3 \end{bmatrix}$$

13. solve simple matrix equations such as:

    a. $X + \begin{bmatrix} 2 & 3 \\ -1 & 0 \end{bmatrix} = \begin{bmatrix} -4 & 2 \\ 3 & 1 \end{bmatrix}$

    b. $3X - \begin{bmatrix} 2 & -1 \\ 3 & -2 \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 4 & -5 \end{bmatrix}$

14. multiply two conformable matrices (no attempt should be made to make the students adept in writing products in general summation notation. All that should be required is that given two conformable matrices of reasonable dimensions, the student should be able to compute the product).
15. square or cube a given square matrix.
16. state whether or not two given matrices are conformable for multiplication.
17. write the identity matrix for multiplication for matrices of a stated dimension.

18. state that multiplication of matrices is not commutative.

19. given a determinant write the minor of any given element.

20. given a 2 x 2 or 3 x 3 matrix, compute its determinant using expansion by minors.

21. define the concept of inverse matrices.

22. given two matrices of dimension 2 x 2 or 3 x 3 determine by calculation whether or not they are inverses.

23. state when a 2 x 2 matrix has an inverse.

24. write the inverse of any invertible 2 x 2 matrix.

25. state that for invertible matrices $(AB)^{-1} = B^{-1}A^{-1}$.

26. solve simple matrix equations such as:

$$\begin{bmatrix} 2 & 4 \\ 3 & 1 \end{bmatrix} X = \begin{bmatrix} 4 & 2 \\ 1 & -1 \end{bmatrix}$$

27. given a set of two linear equations in two variables, write the corresponding matrix equation and solve using matrix methods.

STUDENT ASSIGNMENT SHEETS

FOR

A SELF-PACING PROGRAM IN ALGEBRA

VOLUME II

The previous sections on Topical Sequence and Behavioral Objectives may be used with any modern algebra text. In order to see how this may be done, the following section uses a typical algebra text, Modern Algebra, Book II, by Dolciani, Berman, and Freilich as an illustration.

UNIT I

SYSTEMS OF LINEAR OPEN SENTENCES

STUDENT
ASSIGNMENT SHEET

	ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
1.	Open sentences in two variables	Pp. 77-78	Pp. 78-79 Written Ex. 1, 3, 5, 7, 10, 11	
2.	Graphs of linear equations in two variables	Pp. 81-83	P. 83 Oral Ex. 2, 5, 7, 9, 11, 12, 17, 20, 24, 28 P. 84 Written Ex. 5, 9, 12, 20, 28, 31, 33, 35,37	
3.	Slope of a line	Pp. 84-87	Pp. 87-88 Oral Ex. 1-6, 7, 9, 11, 13, 15 Pp. 89-90 Written Ex. 2, 4, 6, 8, 10, 12, 14, 15, 17, 18, 27, 29	
4.	Determining the equation of a line	Pp. 90-93	P. 93 Oral Ex. 1-25 odd P. 94 Written Ex. 1-33 odd, 34, 35, 37, 41	
		SEE TEACHER FOR TEST		
5.	Systems of two linear equations in two variables.	Pp. 95-98	Pp. 98-99 Oral Ex. 1-22 Pp. 99-100 Written Ex. Solve only: 1, 9, 12, 13, 15, 16, 21, 22	

	ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
6.	Determinants of 2 x 2 and 3 x 3 matrices	Pp. 543-544 Pp. 552-553	P. 544 Oral Ex. 1-22 P. 554 Written Ex. 1-12	
7.	Cramer's Rule for 2 x 2 matrices	Teacher will explain	P. 559 Written Ex. 2,4,6,10	
8.	Cramer's Rule for 3 x 3 matrices	Pp. 566-568	P. 568 Written Ex. 1,4,6	
9.	Linear inequalities	Pp. 105-106	P. 106 Oral Ex. 1-21 odd P. 107 Written Ex. 1,6,10,14,18,21,26,31	
		SEE TEACHER FOR TEST		

UNIT II

POLYNOMIALS AND FACTORING

STUDENT
ASSIGNMENT SHEET

	ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
10.	Laws of positive integral exponents and the zero exponent	Pp. 117-119	P. 120 Oral Ex. 1, 3, 4, 7, 10, 11, 12, 13, 15, 18, 20, 22, 24, 26, 27, 30, 32, 34, 36 Written Ex. 1, 5, 6, 10, 12, 13, 15, 17, 19, 21, 24 Also: (1) $5^{\circ} =$ ______ (2) $(-3)^{\circ} =$ ______ (3) $(x + 2)^{\circ} =$ ______ (4) $(x^2)^3 + 7^{\circ} =$ ______	
11.	Products of Polynomials	Pp. 121-122	Pp. 122-124 Oral Ex. 2, 4, 5, 6, 7, 9, 11, 16, 18, 21, 25, 32 Written Ex. 1, 7, 9, 10, 11, 14, 15, 16, 20, 22, 25, 27, 29	
12.	Prime numbers, GCF and LCM of monomials	Pp. 124-126	P. 126 Written Ex. 1, 4, 5, 9, 10, 13, 17, 18 Write all integral factors of 24.	
13.	Review of elementary factoring	Pp. 127-128	P. 128 Oral Ex. 1, 3, 6, 9, 11, 13, 15, 16, 20, 22, 23, 25, 30	

	ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
14.	Factoring polynomials	Pp. 127-128 Section III	Pp. 128-129 Oral Ex. 17, 18 P. 129 Written Ex. 11, 12, 23, 24, 17, 18, 19, 20, 25, 28 Factor $a^3 + a^2 + a + 1$ Factor $27 - 8y^3$	
15.	Factoring quadratic trinomials	Pp. 130-131	P. 132 Written Ex. 1, 2, 3, 6, 7, 10, 11, 13, 15, 16, 18, 19, 27, 28, 31, 33	
16.	Solution of open sentences by factoring	Pp. 134-135 Through Example 2	P. 136 Oral Ex. 1, 3, 5, 7 NOTE: Change the directions in the text to "Find the solution set of each open sentence in the oral exercise."	
*16A.	Solutions and graphs of quadratic inequalities	P. 139	P. 139 Written Ex. 1, 3, 4, 10	
17.	Quotients of polynomials	Pp. 140-141	Pp. 141-142 Written Ex. 1, 7, 8, 10, 13, 15, 13, 20, 21, 25	
* Optional		SEE TEACHER FOR TEST		

UNIT III

RATIONAL NUMBERS AND EXPRESSIONS

STUDENT
ASSIGNMENT SHEET

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
18. Negative exponents	Pp. 153-154	Pp. 154-155 Oral Ex. 1, 4, 5, 8, 9, 10, 11, 13, 14, 15, 16, 19, 20, 21, 23, 25, 26, 28, 29, 30, 31, 32, 34, 35, 36, 37, 39, 41, 43, 45, 46, 47, 49, 51 Pp. 155-156 Written Ex. 1, 5, 9, 17, 19, 21, 23	
19. Rational numbers, expressions, and division by zero	P. 157 Pp. 184-185	P. 158 Written Ex. 1, 5, 7, 11, 14, 15, 17, 18 Pp. 185-186 Written Ex. 1, 4, 6 Write .32 as the quotient of two integers 14, 15	
20. Simplifying rational expressions	Pp. 158-159	P. 160 Oral Ex. 1, 3, 6, 9, 10, 11, 12, 13, 15, 19, 20, 21, 23, 25	
21. Multiplication and division of rational algebraic expressions	Pp. 161-162	P. 162 Written Ex. 3, 5, 7, 9, 11, 13, 16, 17, 19, 21	
	SEE TEACHER	FOR TEST	
22. LCM of two or more polynomials	Pp. 132-133	P. 133 Written Ex. (do part b only) 1, 3, 5, 10, 11, 13, 17	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
22A. Addition and subtraction of rational algebraic expressions	Pp. 164-165	P. 166 Written Ex. 1, 3, 5, 6, 7, 9, 10, 11, 12, 15, 17, 19, 21, 23, 24, 25, 26, 28, 29, 32, 36	
23. Complex fractions	Pp. 167-168	P. 168 Written Ex. 1, 3, 5, 8, 11, 12, 13	
24. Open sentences involving fractions	Pp. 169-170	P. 170 Oral Ex. 1, 3, 5, 7	
25. Problems involving fractions	Pp. 173-174	P. 174 Problems 1, 5, 6, 8, 9	
26. Fractional equations	P. 178 Through Example 1	P. 180 Written Ex. 1, 5, 8, 9, 15 P. 176 Problems 13, 14	
	SEE TEACHER FOR TEST		

UNIT IV

RELATIONS AND FUNCTIONS

STUDENT
ASSIGNMENT SHEET

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
27. Relations	Pp. 203-204	P. 205 Oral Ex. 1-18 Pp. 205-206 Written Ex. 1,2,5,6,13,14,17,18,19 P. 176 Problems 13,14	
28. Functions	Pp. 207-208	Pp. 208-209 Oral Ex. 1-32 Pp. 209-210 Written Ex. 1-15 odd 17,20,21,23,25 28,31,33,35 P. 176 Problems 16,17	
29. Ratio and Proportion		Worksheet P. 181 Problems 1,2	
30. Linear functions and direct variation	Pp. 211-213	Pp. 213-214 Oral Ex. 1,2,3,4,5,8,9,11-18 odd P. 215 Written Ex. 1-10 P. 181 Problems 4,6	
	SEE TEACHER FOR TEST		

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
31. Absolute value	Pp. 14-16	Pp. 16-17 Oral Ex. Give only absolute value 1-12, 27-34 P. 18 Written Ex. 1, 2, 7, 8, 11, 12, 15, 16, 17, 23, 24, 29 P. 206 Written Ex. 7, 8, 11, 12 Pp. 181-182 Problems 8, 10	
32. Special functions	P. 218	P. 219 Written Ex. 1, 3, 9	
33. Quadratic functions and variation	Pp. 220-222	P. 223 Oral Ex. 14-22 Pp. 223-224 Written Ex. 1, 3, 5, 7-10, 11, 13, 15, 17, 19, 21 Optional 23-26 P. 224 Problems 1, 2	
34. Quadratic functions specified by $y = a(x - h)^2 + k$	Pp. 227-228	P. 229 Oral Ex. 1-12, 13, 14, 15, 16 Pp. 229-230 Written Ex. 1-25 odd 29, 30	
35. Quadratic functions specified by $y = ax^2 + bx + c$	Pp. 231-233	Pp. 233-234 Oral Ex. 1-20 P. 234 Written Ex. 1, 4, 9, 13, 18 Pp. 224-225 Problems 5, 7, 13	
	SEE TEACHER FOR TEST		

RATIO AND PROPORTION WORKSHEET

1. Write 3:2 as a fraction.
2. Identify the first and second terms of the ratios:
   - a. $\frac{5}{7}$
   - b. 6:2
   - c. $7 \div 3$
3. Write the following ratios in lowest terms:
   - a. 9 inches to 1 yard
   - b. 20 minutes to 7 hours
   - c. 2 dollars to 25 cents
   - d. 18 inches to 2 yards
4. Mr. Fields earned $8800 last year and saved $800. What is the ratio of his savings to his earnings?
5. Identify the first, second, third, and fourth terms of each proportion:
   - a. 5:8 = 10:16
   - b. $\frac{7}{3} = \frac{21}{9}$
6. Identify the means and extremes of the proportions in number 5.
7. Solve each of the following proportions:
   - a. $\frac{x}{2} = \frac{3}{4}$
   - b. $\frac{3}{5} = \frac{x + 1}{x - 1}$
   - c. $\frac{x^2}{2x - 1} = \frac{3x + 2}{6}$
   - d. $\frac{x}{3} = \frac{2}{x - 1}$
8. Solve $\frac{R}{r} = \frac{C}{c}$ for r.
9. In a college the number of women and the number of men are in the ratio of 5 to 7. The total enrollment is 2880. How many women and how many men are enrolled?

10. Write each of the following statements in symbols. Let h be the constant of variation in each problem.

    a. The income of a workman varies directly as the number of hours he works.

    b. The perimeter of an equalateral triangle varies directly as the length of a side.

	ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
36.	Using radicals to express roots	Pp. 245-247	P. 248 Oral Ex. 1-8, 9, 11, 13, 15, 21, 22 P. 248-249 Written Ex. 1-15 odd, 17-24 Simplify: 1. $\sqrt{5^2}$ 2. $\sqrt[3]{4^3}$ 3. $(\sqrt{2})^2$ Solve: 4. $2x^2 = 8$ 5. $3x^5 + 1 = 0$ State the conditions on N or b so that each of the following define real numbers. 6. $\sqrt[n]{2}$ 8. $\sqrt[3]{b}$ 7. $\sqrt[n]{-4}$ 9. $\sqrt{b}$ Which of the following are real numbers? 10. $\sqrt[6]{16}$ 12. $\sqrt[3]{16}$ 11. $\sqrt[7]{-56}$ 13. $\sqrt{-1}$	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
		Use the identities $\sqrt[n]{x^n} = x$ if n is even, $\sqrt[n]{x^n} = x$ if n is odd to simplify each of the following expressions: 14. $\sqrt[4]{(-5)^4}$ 17. $\sqrt[15]{(-2)^{15}}$ 15. $\sqrt[5]{5^5}$ 18. $\sqrt[16]{(-2)^{16}}$ 16. $\sqrt[3]{(-3)^3}$	
37. Rational and irrational roots	Pp. 249-251	P. 252 Oral Ex. 1-23 odd Written Ex. 1, 3, 6, 8, 11, 15, 17, 19, 20	
38. Rational operations	Pp. 253-254	P. 253 Written Ex. 1, 2, 4, 5, 7	
	SEE TEACHER FOR TEST		
39. Decimals for real numbers	Pp. 184-185 Pp. 255-257	P. 186 Written Ex. 10, 13, 15, 16, 18 P. 257 Oral Ex. 1-12 P. 257 Written Ex. Insert a rational only 5, 6, 8, 10, 12, 15, 16	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
40. Rational numbers as exponents	Pp. 333-334	P. 334 Oral Ex. 1, 2, 3, 6, 7, 10, 11, 13 P. 335 Written Ex. 1, 3, 4, 5, 7-14, 15, 17, 21, 27, 28, 29, 33, 35, 36	
41. Properties of radicals	Pp. 258-260	P. 260 Oral Ex. 1-16 Pp. 260-262 Written Ex. 1, 2, 7, 9, 13 Assume all variables are positive in the following problems: 15, 17, 19, 20, 21, 22, 24, 25, 27, 30, 31, 33, 35, 36, 37, 39, 41, 45, 49, 51	
	SEE TEACHER FOR TEST		
42. Simplifying sums of radicals	Pp. 263-264	Pp. 264-265 Written Ex. Combine the radicals and leave answer in simplest radical form: 2, 3, 6, 7, 8 Assume all variables are positive in the following problems: 15, 16, 17, 21, 27, 29	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
43. Products of sums containing radicals	Pp. 265-266	Pp. 266-267 Written Ex. 1, 3, 5, 7, 9, 15, 16, 21, 23, 27, 30, 41	
44. Using radicals to solve quadratic equations	Pp. 268-269	Be able to develop the quadratic formula. Which of the following are quadratic equations? 1. $x^2 = 6x + 2$ 2. $3x + 9 = 0$ 3. $y = 4x + 1$ 4. $x^2 - 6 = 0$ 5. $7(x-2) = 4x + 1$ Identify a, b and c for each of the following equations: 1. $3x^2 - 2x + 1 = 0$ 2. $x^2 + 6x = 15$ 3. $2x - 5 = 10x^2$ 4. $8(x - 3) = x^2$ P. 270 Oral Ex. 1, 3, 4, 5, 7	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
		Pp. 270-271 Written Ex. Leave solutions in simplest radical form only: 1, 4, 5, 9, 12, 17, 20, 23	
45. Relations between roots and coefficients of a quadratic equation	Pp. 273-274	P. 274 Oral Ex. 1, 2, 3, 5, 9, 12 Pp. 274-275 Written Ex. 1, 2, 6	
46. Irrational or radical equations	Pp. 281-232	Which of the following are radical equations? 1. $x\sqrt{2} + 5\sqrt{2} = 0$ 2. $\sqrt{x} = 3$ 3. $\sqrt{x+1} - 2 = \sqrt{3}$ Pp. 282-283 Written Ex. 1, 3, 5, 9, 23, 24, 27, 37	
	SEE TEACHER FOR TEST		

UNIT VI

COMPLEX NUMBERS

STUDENT
ASSIGNMENT SHEET

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
47. Powers of i	Study each example carefully: 1. $i^2 = -1$ 2. $i^3 = i^2 \cdot i =$ $(-1) \cdot i = -i$ 3. $i^4 = i^3 \cdot i =$ $(-i) \cdot i = -i^2 =$ $-(-1) = 1$ 4. $i^5 = i^4 \cdot i =$ $1 \cdot i = i$ 5. $i^6 = i^5 \cdot i =$ $i \cdot i = i^2 = -1$ 6. $i^{38} = i^{36} \cdot i^2 =$ $(i^4)^9 \cdot i^2 =$ $1^9 \cdot i^2 =$ $1\,(-1) = -1$ 7. $i^{109} = i^{108} \cdot i$ $= (i^4)^{27} \cdot i =$ $1^{27} \cdot i =$ $1 \cdot i = i$	Problems: 1. $i^8 =$ __________ 2. $i^9 =$ __________ 3. $i^{17} =$ __________ 4. $i^{22} =$ __________ 5. $i^{39} =$ __________ 6. $i^{100} =$ __________ 7. $i^{62} =$ __________ 8. $i^{284} =$ __________	

	ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
48.	Products and quotients of pure imaginary numbers	Text P. 404	Worksheet Write each problem in the i form: 1. $\sqrt{-25}$ 4. $\sqrt{-9}$ 2. $\sqrt{-8}$ 5. $\sqrt{-27}$ 3. $\sqrt{-4}$ 6. $\sqrt{-11}$ P. 405 Oral Ex. 1, 4, 7, 8, 12, 13, 21, 22, 24 Written Ex. 5, 7, 9, 11, 13, 14, 16, 18, 21, 23, 24, 26, 27, 29 Which of the following numbers are pure imaginary numbers? 5, 2i, $\sqrt{3i}$, $\sqrt{2}$, π, -6i, 0	
49.	Sums and differences of pure imaginary numbers	Text P. 404 through Example 1	P. 406 Written Ex. 33, 34, 35, 36, 37, 38, 39, 40 Solve each equation: 1. $x^2 + 9 = 0$ 2. $4x^2 + 9 = 0$ 3. $7x^2 + 3 = 0$	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
50. Addition and subtraction of complex numbers	Text Pp. 399-400	1. Write 7 in the form a + bi. 2. Write 3i in the form a + bi. 3. True or False: 3 - 2i = 3 + 2i. 4. Solve: a + 3i = 4 - bi for a and b P. 401 Written Ex. 13, 14, 15, 17 P. 401 Oral Ex. 9, 10, 11, 12, 13, 14	
51. Multiplication and division of complex numbers	Text Pp. 406-408 Skip Example 1	P. 408 Oral Ex. 1-10 Write the conjugate of each of the following numbers: 1. 3 + 2i 4. 4i 2. 5 - 7i 5. -3i 3. 6 6. 0 Pp. 408-409 Written Ex. 9, 10, 11, 12, 14, 15 Write the multiplicative inverse of each of the following numbers: 1. 3 + 4i 3. 1 + i 2. 2 - 3i 4. 15	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
		P. 409 Written Ex. 19-24 1. Draw a Venn diagram of the complex number system.	
52. The complex plane	Reference: Alg. II with Trigonometry, Payne, Zamboni, and Lank Ford Pp. 175-181	P. 401 Written Ex. 1, 3, 5, 9, 11, 12 Plot vectors in the complex plane to find the following sums of complex numbers: 1. $(3 + 2i) + (-1 + 5i)$ 2. $(5 - 6i) + (-4 + 2i)$ True or False: $i > 0$ Which is greater? $3 + 2i$ or $2 + 3i$	
53. Quadratic equations	Text Study Example 1, P. 407	P. 408 Written Ex. 1, 2, 4, 5, 6	
54. The discriminant	Text Pp. 275-278	P. 278 Written Ex. 1, 3	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
		Determine the nature of the roots of the following quadratic equations: 1. $x^2 + 2x + 5$ 2. $4x^2 + 4x + 1$ 3. $x^2 - 4x + 5 = 0$ 4. $n^2 - n = 7$ 5. $7b^2 - 5b + 2 = 0$ Determine the value(s) of h so that the equation: $x^2 - x + h = 0$ has a. one real solution, b. two real solutions, and c. two imaginary solutions. P. 278 12, 13	
	SEE TEACHER FOR TEST		

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
55. Definition of a logarithm	See teacher	Pp. 339-340 Oral Ex. 1-22 P. 340 Written Ex. 1-31 odd	
56. Approximations	Pp. 186-188	P. 189 Oral Ex. 1-27 odd Pp. 189-190 Written Ex. 1-25 odd, 27-30 Give the (a) Precision and (b) Accuracy of each of the following measurements: 1. 235 pounds 2. .002 grams 3. 24 feet	
57. Common logarithms	Pp. 341-343	P. 343 Written Ex. 1-31 odd	
58. Interpolation	Pp. 343-345	Pp. 345-346 Written Ex. 1, 2, 6, 7, 9, 13, 14, 17, 21, 24	
59. Products and quotients	Pp. 346-348	P. 349 Oral Ex. 1-6, 7, 13, 15, 17, 20, 25 Written Ex. 1, 7, 9, 11, 14, 19, 21, 23, 25, 27, 30	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
60. Powers and roots	Pp. 350-351	P. 351 Oral Ex. 1-6, 7, 10, 11, 17, 20, 22, 25 Written Ex. 1, 4, 5, 11, 14, 16, 19 Optional 21, 22	
61. Combined operations	Pp. 352-353	Pp. 354-355 Written Ex. 1, 5, 10, 14, 17, 21, 26, 30, 33, 35, 36, 40	
62. Using logarithms to solve equations	Pp. 357-358	P. 358 Written Ex. DO NOT use logarithm tables - 1, 5, 6, 8, 9	
	SEE TEACHER FOR TEST		

UNIT VIII

PROGRESSIONS AND THE BINOMIAL EXPANSION

STUDENT
ASSIGNMENT SHEET

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
63. Arithmetic progressions	Pp. 487-488	1. Which of the following are arithmetic progressions? a. 1, 3, 5, 7, 9, . . . b. 2, 5, 8, 9, 12, . . c. 2, 4, 8, 16, . . . 2. Give the next term in the arithmetic progression: 5, 1, -3, ___, ... 3. What is the common difference in the arithmetic progression in number 2? P. 489 Written Ex. 1, 4, 7, 9, 10, 14, 15, 17, 21 Problems 1, 2	
64. Arithmetic means	Pp. 490-491	Pp. 491-492 Written Ex. 1, 2, 6, 9, 11 P. 490 Problems 4, 7	
65. Sum of an arithmetic progression	Pp. 493-494	P. 494 Oral Ex. 1, 3, 5, 6, 7 Pp. 495-496 Written Ex. 1, 2, 4, 5, 9, 11, 13, 15, 22, 25 P. 496 Problems 1, 2, 3	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
66. Geometric progression	Pp. 498-499	Which of the following are geometric progression? 1. 1, 2, 4, 8, 16, . . . 2. $\frac{1}{2}, -\frac{1}{4}, \frac{1}{8}, -\frac{1}{16}\ldots$ 3. 5, 4, 3, 1, . . . 4. What is the common ratio of the geometric progression: 2, -6, + 18, -54, . . . 5. Give the next term of the geometric progression $\frac{1}{4}, \frac{1}{20}, \frac{1}{100}, \ldots.$ P. 499 Oral Ex. 1, 3, 7 Pp. 499-500 Written Ex. 1, 4, 7, 9, 19	
67. Geometric means	Pp. 501-502	P. 502 Oral Ex. 1, 2, 3, 7, 10, 11, 18 Pp. 502-503 Written Ex. 1, 3, 9 P. 500 Written Ex. 21, 23	

	ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
68.	Geometric series	Pp. 503-504	1. Write the series that corresponds to the geometric progression $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \ldots.$ P. 505 Written Ex. 1, 2, 15, 16, 17, 20 P. 500 Written Ex. 24, 26	
		SEE TEACHER	FOR TEST	
69.	Infinite geometric series	Pp. 507-508	P. 508 Written Ex. 1, 2, 5, 6, 9 P. 500 Problems 1, 2, 3, 4 P. 503: 19	
70.	Pascal's triangle and powers of binomials	P. 510	Write the first 6 rows of Pascal's triangle. P. 511 Written Ex. 1, 3, 7, 11, 21, 27, 29 P. 506 Problems 1, 2	
71.	The general binomial expansion	Pp. 511-512	P. 513 Written Ex. 1, 4, 7, 10 P. 509 Problems 1, 2	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
72. Factorial notation	P. 512 SEE TEACHER FOR TEST	Expand each expression: 1. 5! = 3. 0! = 2. 3! = 4. 1! = Simplify each expression: 5. 3! 2! = 6. (3 x 2)! = 7. $\frac{5!}{3!} =$ 8. $\frac{6!}{4!\,2!}$	

UNIT IX

PERMUTATIONS, COMBINATIONS & PROBABILITY

STUDENT
ASSIGNMENT SHEET

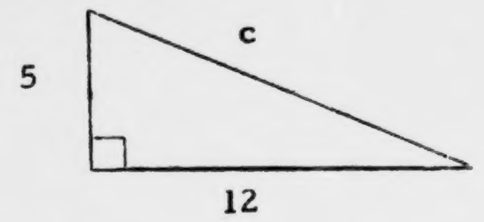
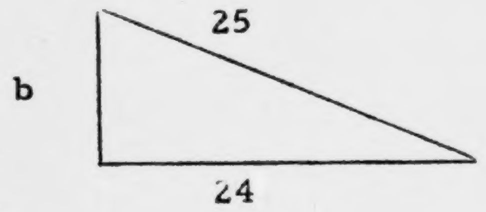
	ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
73.	Fundamental counting principles	Pp. 573-575	Given the following sets, write A x B, B x C, C x A: A = { 1, 2, 3 } B = { 9, 10 } C = { a, b, c, d, e } P. 575 Written Ex. 1, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 17, 18, 20, 22	
74.	Linear and circular permutations	Pp. 576-578	Pp. 578-579 Written Ex. 1, 2, 3, 5, 8, 9, 10, 11, 12, 13, 15, 17, 18, 19, 21, 27, 29	
75.	Permutations of elements not all different	P. 580	P. 581 Written Ex. 1, 3, 5, 9, 13, 14, 15, 17	
76.	Combinations	Pp. 581-583	Pp. 583-584 Written Ex. 1, 3, 5, 6, 8, 10, 11, 12, 13, 15, 16, 17, 20	
77.	Combinations formed from several sets	P. 585	Pp. 586-587 Written Ex. 1, 3, 5, 6	
78.	The binomial theorem and Pascal's triangle	Pp. 587-589	P. 589 Written Ex. 1, 2, 7, 8, 12	
		SEE TEACHER FOR TEST		

	ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETEI
79.	Sample spaces and events	Pp. 589-591	Pp. 591-592 Written Ex. 1, 2, 3, 5, 6, 7, 9, 10	
80.	Meaning of mathematical probability	Pp. 592-593	Pp. 594-596 Written Ex. 1, 2, 4, 5, 6, 7, 9, 11, 14, 15	
81.	Mutually exclusive events	Pp. 596-597	Pp. 597 Written Ex. 1, 2, 3, 6, 7, 8	
82.	Independent and dependent events	Pp. 598-599	Pp. 600-601 Written Ex. 1, 2, 3, 4, 8, 9, 10, 15	
		SEE TEACHER FOR TEST		

UNIT X

QUADRATIC RELATIONS AND SYSTEMS

STUDENT
ASSIGNMENT SHEET

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
83. Distance formula	Pp. 293-295	Find the length of the unknown side of each triangle below: 1.  $c =$ _____ 2.  $b =$ _____ P. 295 Written Ex. 1, 5, 6, 11, 13, 21	
84. The circle	Pp. 300-302	P. 302 Written Ex. 1, 2, 4, 6, 10 1. Transform each equation to the form: $(x-h)^2 + (y-k)^2 = r^2$ $x^2 + y^2 - 4x + 2y - 11 = 0$ 2. Give the center and radius of the circle: $x^2 + y^2 + 2x - 6y + 9 = 0$	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
		3. Which of the following equations define circles? a. $y = 3x + 2$ b. $x^2 - y^2 = 25$ c. $x^2 + y^2 = 36$ d. $3x^2 + 2y^2 = 16$ e. $x^2 + y = 0$ 4. Graph: a. $x^2 + (y-2)^2 \le 9$ b. $(x-4)^2 + (y+2)^2 > 1$	
85. The parabola	Pp. 220-222 (Review Reading) Pp. 303-305	1. Transform the following relations into standard form and state: a. equation of the axis of symmetry; b. the coordinates of the vertex; c. the direction of concavity; d. whether the vertex is a maximum or a minimum point. e. Graph these relations: a. $y = 2(x-1)^2 + 2$ b. $y = x^2 - 4x - 1$	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
		c. $y = -27 - 10x - x^2$ d. $x = y^2 - 4y + 1$ 2. Find the equation of the parabola whose directrix is the line $x = -1$ and whose focus is the point $P(1, 0)$. P. 306 Written Ex. 15 3. Which of the following equations define parabolas? a. $y = x - 2$ b. $y = x^2$ c. $x^2 + y^2 = 25$ d. $4x^2 - y = 0$	
	SEE THE TEACHER FOR TEST		
86. The ellipse	Pp. 306-308	Pp. 308-309 Written Ex. 1, 4, 18 1. Write the equation $x^2 + 9y^2 = 144$ in standard form. 2. Write $\frac{x^2}{4} + \frac{y^2}{9} = 1$ in general form.	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
		3. Which of the following equations define ellipses? a. $x^2 + y^2 = 16$ b. $y = x^2 - 4x + 2$ c. $4x^2 + 9y^2 = 8$ d. $4x^2 - 9y^2 = 144$ 4. Draw the graph of: $\{(x_1y) \mid 4x^2 + 25y^2 < 100\}$ 5. Find the equation of the ellipse with foci $F_1(-3, 0)$ and $F_2(3, 0)$ and 10 as the sum of the length of the focal radii.	
87. The hyperbola	Pp. 309-311	Pp. 311-313 Written Ex. 1, 3, 4, 21 1. Write $x^2 - 16y^2 - 144 = 0$ in standard form. 2. Write $\frac{x^2}{9} - \frac{y^2}{16} = 1$ in general form. 3. Which of the following equations define hyperbolas? a. $x^2 - y^2 = 1$ b. $x^2 - 16y^2 = 1$	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
		c. $x^2 + y^2 = 25$ d. $x^2 + 5y = 0$ 4. Identify the graph defined by each equation: a. $x^2 + y^2 = 16$ b. $x^2 + 4y^2 = 16$ c. $y = 8x^2 - 3x + 2$ d. $x^2 - 16y^2 = 144$ 5. Name all the conic sections.	
88. Linear-quadratic systems (graphical solution)	Pp. 318-319	P. 319 Written Ex. 16 Find the common solution to the system: $y = x^2$ $y = x$ by the graphical method.	
89. Linear-quadratic system (substitution method)	Pp. 320-321	P. 321 Written Ex. 2, 11	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
90. Quadratic-quadratic systems	Pp. 323-324	Pp. 324-325 Written Ex. 1,2,9 Draw a diagram of a parabola intersecting a circle in three distinct points.	
	SEE TEACHER	FOR TEST	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
91. Matrix terminology	Pp. 543-544	P. 544 Oral Ex. 1, 2, 3, 4, 5, 7 1. What is the third column of: $\begin{bmatrix} 1 & 2 & 5 & 7 \\ 3 & 4 & 3 & 4 \\ 4 & 2 & 0 & 1 \end{bmatrix}$ 2. Write the element in the third row, second column of: $\begin{bmatrix} 5 & 2 & 3 \\ 2 & 1 & 0 \\ 0 & 4 & 3 \end{bmatrix}$ 3. Write the transpose of: $\begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 0 \end{bmatrix}$ 4. $\begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix} \begin{matrix} 1 \\ 0 \end{matrix}^{T} =$ 5. Write the zero matrix of dimensions 3 x 2.	
92. Addition and scalar multiplication of matrices	Pp. 545-546	Pp. 546-548 Written Ex. 1, 2, 4, 6, 7, 8, 11, 13, 14, 16, 17	

ASSIGNMENT TOPIC	READING	ASSIGNMENT	DATE COMPLETED
		1. Write the additive inverse of: $\begin{bmatrix} 3 & -2 \\ -5 & 0 \end{bmatrix}$	
93. Matrix multiplication	Pp. 548-551	P. 551 Written Ex. 1, 3, 5 1. $\begin{bmatrix} 2 & 1 \\ -1 & 2 \end{bmatrix} \times \begin{bmatrix} 1 & 2 & -10 \\ 3 & 4 & 12 \end{bmatrix}$ P. 551 Written Ex. 9, 12	
94. The determinant function ✓	Pp. 552-554	P. 554 Written Ex. 1, 7	
95. Inverses of 2 x 2 matrices	Pp. 554-556	P. 556 Written Ex. 1, 2, 13	
96. Solution of systems of lin linear equations by matrix method	Pp. 558-559	P. 559 Written Ex. 1, 2	
97. Expansion of minors	Pp. 559-562	P. 562 Written Ex. 1, 3	
	SEE TEACHER FOR TEST		

APPENDIX A

DIAGNOSTIC TESTS

FOR

A SELF-PACING PROGRAM IN ALGEBRA

VOLUME II

DIAGNOSTIC TEST PART I

DIRECTIONS: Do not write on test booklet. Do all scratch work on the paper provided to you. Place all answers on the answer sheet. Do not spend too much time on any one problem.

Perform indicated operations (problems 1 through 16)

1. $(-8) + (+3)$
2. $(-4) + (-7)$
3. $(+8) - (-5)$
4. $-2 - 6$
5. $(-10)(+3)$
6. $(-9)(-2)$
7. $(+20) \div (-4)$
8. $\frac{-18}{-6}$
9. $\frac{3}{5} - \frac{1}{5}$
10. $\frac{3}{4} + \frac{1}{3}$
11. $\frac{2}{7} \cdot \frac{35}{14}$
12. $\frac{4}{9} \div \frac{24}{27}$
13. $8 \div 4 + 3 \cdot 5$
14. $3 \cdot (4+1) - 7$
15. $20 - 2 \cdot 3^2$
16. $8 \div 4 \cdot 2$

Complete the chart for problems 17 through 25. Write "None" if the indicated item does not exist.

	Additive Inverse	Reciprocal	Absolute Value
$\frac{2}{3}$	17.	20.	23.
-5	18.	21.	24.
0	19.	22.	25.

Solve each of the following sentences for the value(s) of the variable which make(s) the sentence true.

26. $b - 3 = 7$

27. $4y = 18$

28. $\frac{1}{3}x = 6$

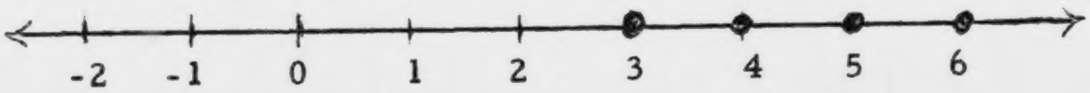
29. $4x + 3 = 17$

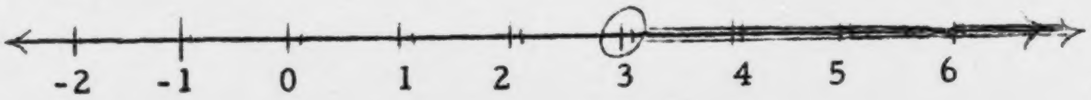
30. $5a + 7 = 3a - 2$

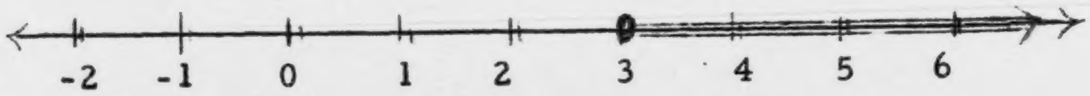
31. $3y - 1 < 10$

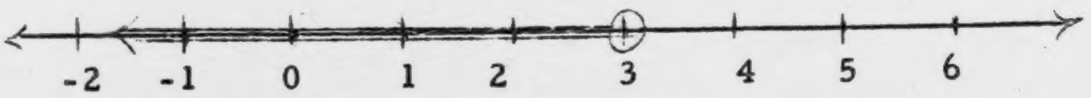
32. $4 - 3d < 5$

33. On your answer sheet write the letter of the correct graph of the solution of $2x > 6$.

A.


B:


C.


D.


E. None of these.

Perform the indicated operations in problems 34 through 50.

34. $a^5 \cdot a^3$

35. $a^4 \cdot a$

36. $(ab)^3$

37. $(2b)^3$

38. $(a^4)^3$

39. $\frac{a^8}{a^6}$

40. $\frac{a^4}{a^9}$

41. 4^0

42. $(3x^2-2x+4) + (x^2+5x-6)$

43. $(3x^2-2x+4) - (x^2+5x-6)$

44. $(4m^3n^2)(-3m^2n^5)$

45. $\frac{-4x^2y}{-6xy^2}$

46. $(2r^2)\,(3r^2+4r-5)$

47. $(2x+1)(x+2)$

48. $(2x-5)^2$

49. $\frac{3a^3-6a^2+18a}{3a}$

50. $x+3\,\big)\overline{x^3+6x^2+7x-6}$

PART I

ANSWER SHEET

NAME ______________________ SECTION __________

TEACHER ______________________ DATE __________

SCORE ______________________ PERIOD __________

1. ____________________
2. ____________________
3. ____________________
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41. ____________________
42. ____________________
43. ____________________
44. ____________________
45. ____________________
46. ____________________
47. ____________________
48. ____________________
49. ____________________
50. ____________________

DIAGNOSTIC TEST PART II

DIRECTIONS: Do not write on the test booklet. Do all scratch work on the paper provided to you. Place all answers on the answer sheet. Do not spend too much time on any one problem.

Factor the following expressions completely.

51. $9a^3-3a^2$

52. x^2-81

53. $x^2+10x+25$

54. $x^2+2x-15$

55. $6x^2-5x-4$

56. $2x^2+10x-28$

In examples 57-58, solve for all values of x which make the sentence true.

57. $(x-2)(x+3) = 0$

58. $x^2-3x-18 = 0$

59. SIMPLIFY: $\frac{x^2-5x+6}{x^2-4x+4}$

In problems 60-68, perform the indicated operation.

60. $\frac{4a}{5} + \frac{3a}{5}$

61. $\frac{5}{3a} - \frac{2}{3a}$

62. $\frac{3x}{2} - \frac{x-3}{2}$

63. $\frac{2R+6}{3s^2} - \frac{4}{5s}$

64. $\frac{x}{3x-9} + \frac{2}{x-3}$

65. $\frac{x}{3a^2} \cdot \frac{6a}{x^2}$

66. $\frac{x^2-9}{x+1} \cdot \frac{(x+1)^2}{x^2-6x+9}$

67. $\frac{4bc}{3a} \div \frac{2b^2}{3a}$

68. $\frac{x^2+7x+12}{x^2-9} \div \frac{2x+8}{x-3}$

69. SIMPLIFY: $\dfrac{\frac{x^2}{3y}}{\frac{3x}{y^2}}$

Solve each of the following open sentences for the variable.

70. $\frac{x}{2} + \frac{x+1}{3} = \frac{1}{6}$

71. $\frac{7}{a+2} = \frac{13}{a+2}$

72. $\frac{4}{x+1} - \frac{3}{x-1} = \frac{1}{x^2-1}$

73. Solve $3x-2y = 6$ for y in terms of x.

74. GRAPH: $3x - 2y = 6$

75. GRAPH: $y = \frac{1}{2}x - 3$

76. SOLVE: $x + y = 6$

$x - y = 4$

77. SOLVE: $3x - 2y = 10$

$x + 3y = -4$

Simplify problems 78-81.

78. $\sqrt{84}$

79. $\dfrac{\sqrt{3}}{\sqrt{7}}$

80. $\sqrt{27} + \sqrt{12}$

81. $\dfrac{3}{1 + \sqrt{5}}$

82. SOLVE: $\sqrt{x+7} = 5$

ANSWER SHEET - Diagnostic Test PART II

NAME ______________________________ SECTION ______________

TEACHER ______________________________ DATE ______________

SCORE ______________________________ PERIOD ______________

51. ______________________

52. ______________________

53. ______________________

54. ______________________

55. ______________________

56. ______________________

57. ______________________

58. ______________________

59. ______________________

60. ______________________

61. ______________________

62. ______________________

63. ______________________

64. ______________________

65. ______________________

66. ______________________

67. ______________________

68. ______________________

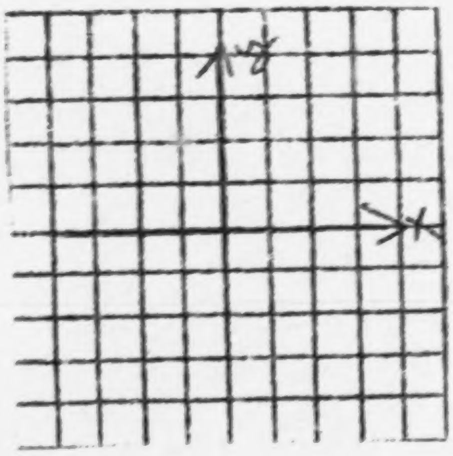
69. ______________________

70. ______________________

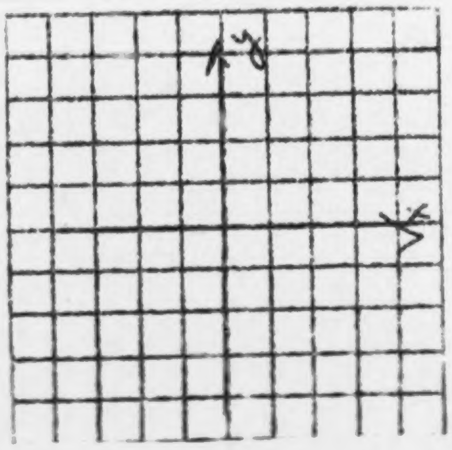
71. ______________________

72. ______________________

73.



74.



75. ______________________

76. ______________________

77. ______________________

78. ______________________

79. ______________________

80. ______________________

81. ______________________

____

TEACHER'S ANSWER KEY

DIAGNOSTIC TEST   Second Year Algebra   PART I

1. -5
2. -11
3. 13
4. -8
5. -30
6. 18
7. -5
8. 3
9. $\frac{2}{5}$
10. $\frac{13}{12}$
11. $\frac{5}{7}$
12. $\frac{1}{2}$
13. 17
14. 8
15. 2
16. 4
17. $-\frac{2}{3}$
18. 5
19. 0
20. $\frac{3}{2}$
21. $-\frac{1}{5}$
22. None
23. $\frac{2}{3}$
24. 5
25. 0
26. 10
27. $\frac{9}{2}$
28. 18
29. $\frac{7}{2}$
30. $-\frac{9}{2}$
31. $y < \frac{11}{3}$
32. $d > -\frac{1}{3}$

33. B

34. a^3

35. a^5

36. a^3b^3

37. $8b^3$

38. a^{12}

39. a^2

40. $a^{\frac{1}{5}}$

41. 1

42. $4x^2 + 3x - 2$

43. $2x^2 - 7x + 10$

44. $-12m^5n^7$

45. $\frac{2x}{3y}$

46. $6R^4 + 8R^3 - 10R^2$

47. $2x^2 + 5x + 2$

48. $4x^2 - 20 + 25$

49. $a^2 - 2a + 6$

50. $x^2 + 3x - 2$

Item Analysis of Test Questions for Diagnostic Purposes

1 - 4	Sum and Differences of directed numbers.
5 - 8	Products and Quotients of directed numbers.
9 - 10	Sums and Differences of fractions.
11 - 12	Products and Quotients of fractions.
13 - 16	Order of operations.
17 - 19	Additive inverse of a number.
20 - 22	Reciprocal of a number.
23 - 25	Absolute value of a number.
26 - 30	Solution of equations with one variable.
31 - 32	Solution of inequalities with one variable.
33	Graph of solution set of inequality on number line.
34 - 41	Fundamental properties of whole number exponents.
42 - 43	Sums and Differences of polynomials.
44 - 50	Products and Quotients of polynomials.

TEACHER'S ANSWER KEY

DIAGNOSTIC TEST Second Year Algebra PART II

51. $3a^2(3a - 1)$

52. $(x + 9)(x - 9)$

53. $(x + 5)^2$

54. $(x + 5)(x - 3)$

55. $(3x - 4)(2x + 1)$

56. $2(x + 7)(x - 2)$

57. $\{2, -3\}$

58. $\{6, -3\}$

59. $\frac{x - 3}{x - 2}$

60. $\frac{7a}{5}$

61. $\frac{1}{a}$

62. $\frac{2x + 3}{2}$

63. $\frac{10R - 12S + 30}{15S^2}$

64. $\frac{x + 6}{3(x - 3)}$

65. $\frac{2}{ax}$

66. $\frac{(x + 3)(x + 1)}{x - 3}$

67. $\frac{2c}{b}$

68. $\frac{1}{2}$

69. $\frac{xy}{9}$

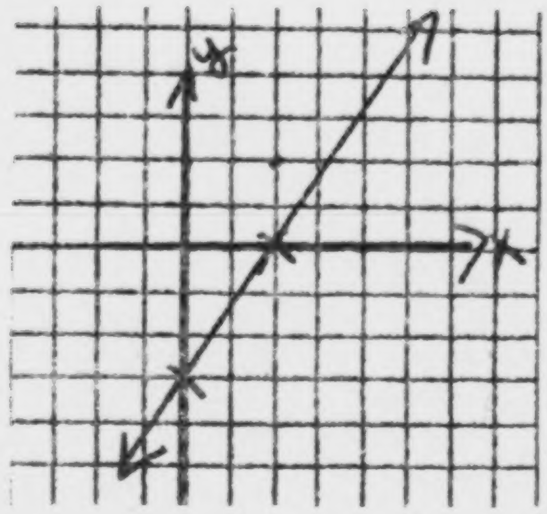
70. $\{-\frac{1}{5}\}$

71. ϕ

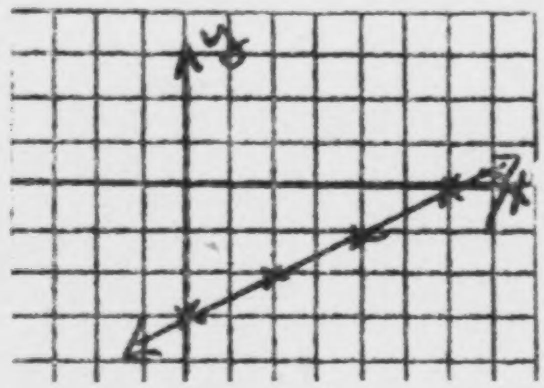
72. $\{8\}$

73. $y = \frac{3x - 6}{2}$

74.



75.



76. $(5, 1)$

77. $(2, -2)$

78. $2\sqrt{21}$

79. $\frac{\sqrt{21}}{7}$

80. $5\sqrt{3}$

81. $\frac{3(1 - \sqrt{5})}{-4}$

82. $\{18\}$

Item Analysis of Test Questions for Diagnostic Purposes

51 - 56	Factoring.
57 - 58	Quadrant equations by factoring.
59	Reducing fractions.
60 - 64	Addition and Subtraction of fractions.
65 - 68	Multiplication and Division of fractions.
69	Complex fractions.
70 - 72	Fractional equations.
73	Solve for y in terms of x.
74 - 75	Graphing linear equations.
76 - 77	Solving system of linear equations.
78 - 79	Multiplication and Division of radicals.
80	Addition of radicals.
81	Simplication of radical expression using conjugates.
82	Irrational equations.

APPENDIX B

ACHIEVEMENT TESTS

FOR

A SELF-PACING PROGRAM IN ALGEBRA

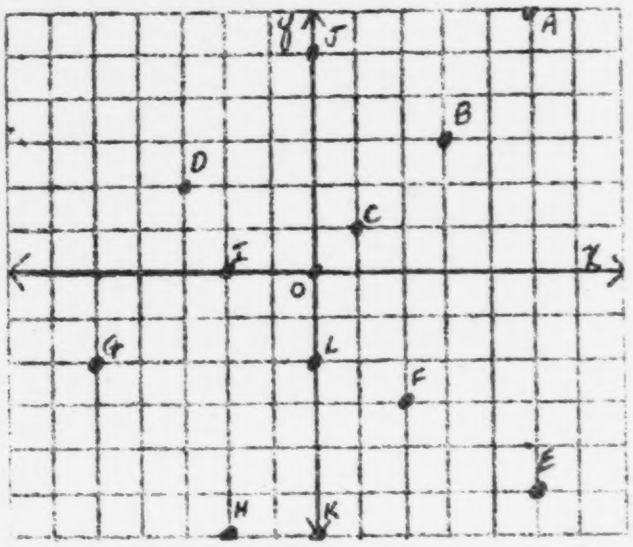
VOLUME II

UNIT I

Systems of Linear Open Sentences

PART I
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.



Problems 1-10 refer to the diagram above.

1. The coordinates of point A are____________________.

2. The coordinates of point G are____________________.

3. The coordinates of point J are____________________.

4. Point D is in quadrant____________________.

5. Point E is in quadrant____________________.

6. The abscissa of point H is____________________.

7. The ordinate of point I is____________________.

8. The ordered pair (2, -3) is associated with point____________________.

9. The ordered pair (0, -2) is associated with point____________________.

10. Three points on the y-axis are____________________.

In Problems 11-14 tell whether or not the given equation is linear. Answer yes or no.

11. $x + y = 3$

12. $2x - 5y + 7 = 0$

13. $x^2 + y = 9$

14. $xy = 5$

In Problems 15-17 tell whether or not the given ordered pair is a solution of the given equation. Answer yes or no.

15. $(6, 2)$; $2x - 3y = 6$

16. $(1, -7)$; $5y + x = -2$

17. $(0, 3)$; $\frac{4}{5}x + 2y - 6 = 0$

18. The ordered pair (___, 6) belongs to the solution set of $2x + y = 4$.

19. The ordered pair $(-\frac{3}{5}$, ___) belongs to the solution set of $5x - 3y = -15$.

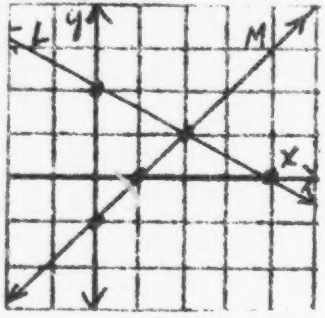
20. Give three ordered pair solutions to $x - 3y = 6$ and use these solutions to sketch a graph.

Solve each of the equations in Problems 21 and 22 for y in terms of x.

21. $2x - y = 7$

22. $3y - x = -9$

Problems 23-26 refer to the graph below.



23. The y-intercept of line L is_____________________________.

24. The x-intercept of line M is_____________________________.

25. The slope of line L is________________________________.

26. The slope of line M is________________________________.

27. Calculate the slope of the line joining points (6, 1) and (10, -3).

In Problems 28-35 select the entry in Column II that matches the entry in Column I. Answer by giving the correct letter.

I

28. $y = mx + b$

29. $ax + by + c = 0$

30. $y - y_1 = m(x - x_1)$

31. $\frac{y_2 - y_1}{x_2 - x_1}$

32. the y-intercept of $y = mx + b$

33. $x = 1$

34. the inventor of the Cartesian coordinate system

35. (0, 0)

II

A. the equation of a horizontal line

B. quadratic equation

C. point-slope form

D. Isaac Newton

E. y-intercept form

F. René Descartes

G. coordinates of the origin

H. slope

I. the equation of a vertical line

J. general form of a linear equation

K. b

L. Joe Cart

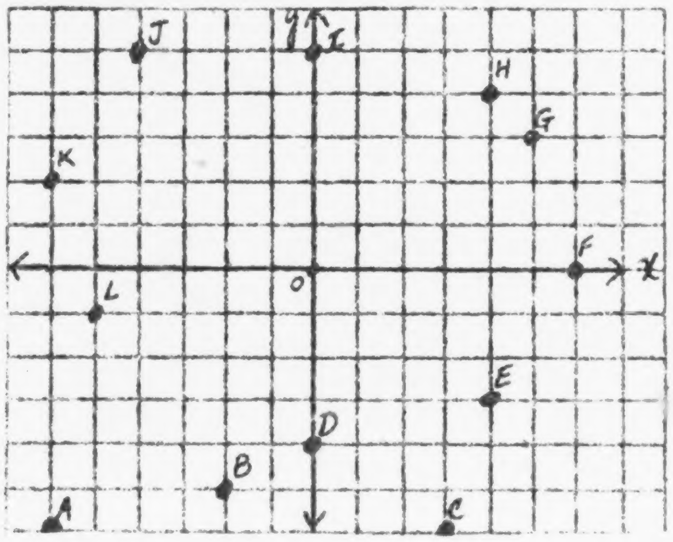
In Problems 36-38 find the equation of the line that satisfies the given conditions. Write all answers in $ax + by + c = 0$ form.

36. $m = 2$ and $b = -3$

37. Slope = 4 and passing through the point (2, 1).

38. Passing through the points (-7, 2) and (1, 18).

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.



Problems 1-10 refer to the diagram above.

1. The coordinates of point A are ____________________.

2. The coordinates of point G are ____________________.

3. The coordinates of point I are ____________________.

4. The point J is in quadrant ____________________.

5. The point C is in quadrant ____________________.

6. The abscissa of point B is ____________________.

7. The ordinate of point D is ____________________.

8. The ordered pair (3, -6) is associated with point ____________.

9. The ordered pair (0, -4) is associated with point ____________.

10. Three points on the y-axis are ____________________.

In Problems 11-14 tell whether or not the given equation is linear. Answer yes or no.

11. $3x - 6y - 11 = 0$

12. $xy = 9$

13. $y^2 + x - 9 = 4$

14. $y - x = 6$

In Problems 15-17 tell whether or not the given ordered pair is a solution of the given equation. Answer yes or no.

15. $(8, 2)$; $2x - 3y = 6$

16. $(0, -\frac{2}{5})$; $5y + x = -2$

17. $(10, -1)$; $\frac{4}{5}x + 2y - 6 = 0$

18. The ordered pair (___, 4) belongs to the solution set of $2x + y = 4$.

19. The ordered pair (-2, ___) belongs to the solution set of $5x - 3y = -15$.

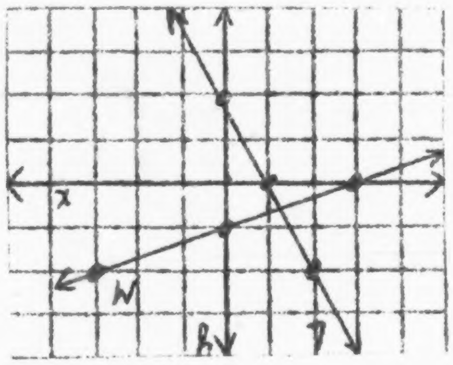
20. Give three ordered pair solutions to $2x - y = 4$ and use these solutions to sketch a graph.

Solve each of the equations in Problems 21 and 22 for y in terms of x.

21. $3x - y = 10$

22. $2y - 4x = -12$

Problems 23-26 refer to the graph below.



23. The y-intercept of line L is ____________________.

24. The x-intercept of line M is ____________________.

25. The slope of line L is ____________________.

26. The slope of line M is ____________________.

27. Calculate the slope of a line joining points $(-4, 5)$ and $(-5, 2)$.

In Problems 28-35 select the entry in Column II that matches the entry in Column I. Answer by giving the correct letter.

I

28. $y = mx + b$

29. $ax + by + c = 10$

30. $y - y_1 = m(x - x_1)$

31 $\frac{y_2 - y_1}{x_2 - x_1}$

32. the y-intercept of $y = mx + b$

33. $x = 1$

34. the inventor of the Cartesian coordinate system

35. (0, 0)

II

A. the equation of a horizontal line

B. quadratic equation

C. point-slope form

D. Isaac Newton

E. y-intercept form

F. Rene Descartes

G. coordinates of the origin

H. slope

I. the equation of a vertical line

J. general form of a linear equation

K. b

L. Joe Cart

In Problems 36-38 find the equation of the line that satisfies the given conditions. Write all answers in $ax + by + c = 0$ form.

36. $m = \frac{1}{2}$ and $b = 5$

37. Slope = 3 and passing through the point (-1, 2).

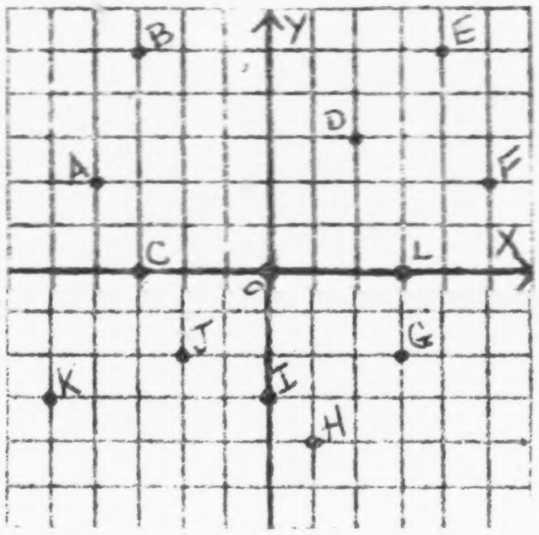
38. Passing through the points (0, -1) and (4, 3).

UNIT I

Systems of Linear Open Sentences

PART I
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.



Problems 1-10 refer to the diagram above.

1. The coordinates of point C are____________________.
2. The coordinates of point B are____________________.
3. The coordinates of point K are____________________.
4. Point H is in quadrant____________________:
5. Point J is in quadrant____________________.
6. The abscissa of point A is____________________.
7. The ordinate of point L is____________________.
8. The ordered pair (0, -3) is associated with point____________.
9. The ordered pair (3, -2) is associated with point____________.
10. The point that has both coordinates the same is point__________.

In Problems 11-14 tell whether or not the given equation is linear. Answer yes or no.

11. $3x - 4y = 5$

12. $x^4 - x^2 = 1$

13. $2x = y$

14. $3x - 4y^2 = 10$

In Problems 15-17 tell whether or not the given ordered pair is a solution of the given equation. Answer yes or no.

15. $(2, 3)$; $2x - 3y = 13$

16. $(-1, 1)$; $4x - 4y = -8$

17. $(-5, 0)$; $y - 3x = -5$

18. The ordered pair (___, 2) belongs to the solution set of $5x - y = -12$.

19. The ordered pair ($\frac{1}{2}$, ___) belongs to the solution set of $4x - 6y = 8$.

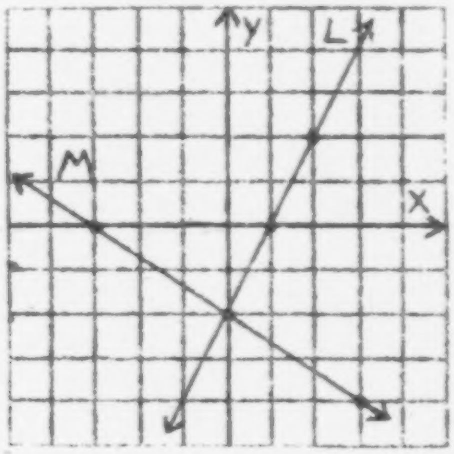
20. Give three ordered pair solutions to $4x - y = 5$ and use these solutions to sketch a graph.

Solve each of the equations in Problems 21 and 22 for y in terms of x.

21. $3x + 3y = 9$

22. $4x - 3y = 5$

Problems 23-26 refer to the graph below.



23. The y-intercept of line L is________________________.

24. The x-intercept of line M is________________________.

25. The slope of line L is____________________________.

26. The slope of line M is_________________________.

27. Calculate the slope of the line joining points (5, 4) and (-1, -2).

In Problems 28-35 select the entry in Column II that matches the entry in Column I. Answer by giving the correct letter.

I

28. $y = mx + b$

29. $ax + by + c = 0$

30. $y - y_1 = m(x - x_1)$

31. $\frac{y_2 - y_1}{x_2 - x_1}$

32. the y-intercept of $y = mx + b$

33. $x = 1$

34. the inventor of the Cartesian coordinate system

35. (0, 0)

II

A. the equation of a horizontal line

B. quadratic equation

C. point-slope form

D. Isaac Newton

E. y-intercept form

F. René Descartes

G. coordinates of the origin

H. slope

I. the equation of a vertical line

J. general form of a linear equation

K. b

L. Joe Cart

In Problems 36-38 find the equation of the line that satisfies the given condition. Write all answers in $ax + by + c = 0$ form.

36. $m = -1$ and $b = 5$

37. Slope $= \frac{2}{3}$ and passing through the point (-1, 2).

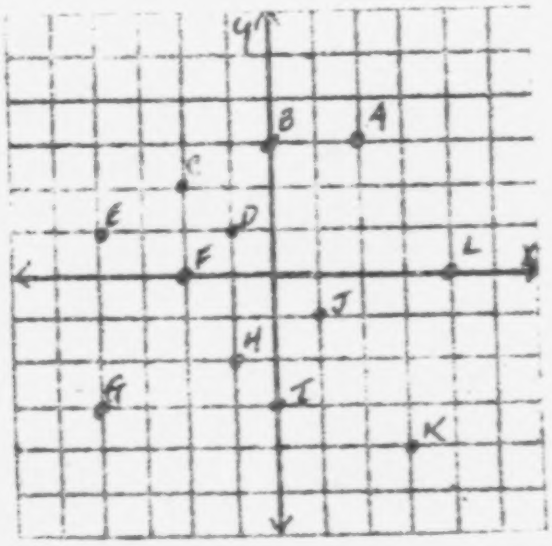
38. Passing through the points (3, -2) and (-2, 5).

UNIT I

Systems of Linear Open Sentences

PART I
Test D

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.



Problems 1-10 refer to the diagram above.

1. The coordinates of point F are ______________________________.
2. The coordinates of point H are ______________________________.
3. The coordinates of point G are ______________________________.
4. Point J is in quadrant ______________________________.
5. Point A is in quadrant ______________________________.
6. The abscissa of point C is ______________________________.
7. The ordinate of point D is ______________________________.
8. The ordered pair (2, 3) is associated with point ______________.
9. The ordered pair (-4, 1) is associated with point ______________.
10. Two points on the y-axis are ______________________________.

In Problems 11-14, tell whether or not the given equation is linear. Answer yes or no.

11. $x^2 + 3y = 2$

12. $3x - 2y = 5$

13. $xy = 6$

14. $x + y = 4$

In Problems 15-17 tell whether or not the given ordered pair is a solution of the given equation. Answer yes or no.

15. $(3, 2)$; $3x - 2y = 4$

16. $(1, -3)$; $2x + y = -1$

17. $(0, 5)$; $\frac{3}{7}x + 2y - 10 = 0$

18. The ordered pair (____, 5) belongs to the solution set of $2x + y = 9$.

19. The ordered pair $(-\frac{3}{7}$, ____) belongs to the solution set of $7x - 2y = 7$.

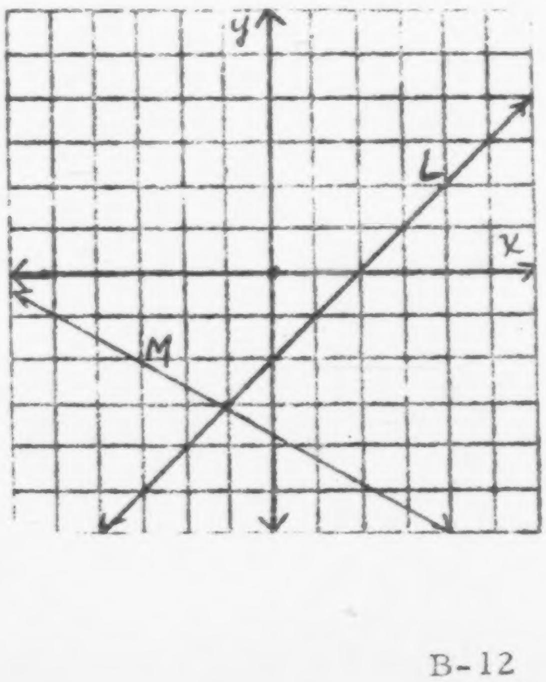
20. Give three ordered pair solutions to $x + 3y = 6$ and use these solutions to sketch a graph.

Solve each of the equations in Problems 21 and 22 for y in terms of x.

21. $3x - y = 6$

22. $3y - x = -7$

Problems 23-26 refer to the graph below.



23. The y-intercept of line L is____________________.

24. The x-intercept of line L is____________________.

25. The slope of line L is____________________.

26. The slope of line M is____________________.

27. Calculate the slope of the line joining points $(3, -5)$ $(6, -9)$.

In Problems 28-35, select the entry in Column II that matches the entry in Column I. Answer by giving the correct letter.

I

28. $(0, 0)$
29. $x = 1$
30. $ax + by + c = 0$
31. $y - y_1 = m(x - x_1)$
32. $y = mx + b$
33. $\dfrac{y_2 - y_1}{x_2 - x_1}$
34. the y-intercept of $y = mx + b$
35. the inventor of the Cartesian coordinate system

II

A. the equation of a horizontal line
B. quadratic equation
C. point-slope form
D. Isaac Newton
E. y-intercept form
F. Rene Descartes
G. coordinates of the origin
H. slope
I. the equation of a vertical line
J. general form of a linear equation
K. b
L. Joe Cart

In Problems 36-38, find the equation of the line that satisfies the given conditions. Write all answers in $ax + by + c = 0$ form.

36. $m = 3$ and $b = -2$

37. Slope = 5 and passing through the point $(3, 5)$.

38. Passing through the points $(-7, 1)$ and $(1, 17)$.

UNIT I

Systems of Linear Open Sentences

PART I
Test A B C D

NAME ____________________ SECTION ____________

TEACHER ____________________ DATE ____________

SCORE ____________________ PERIOD ____________

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

8. ____________________

9. ____________________

10. ____________________

11. ____________________

12. ____________________

13. ____________________

14. ____________________

15. ____________________

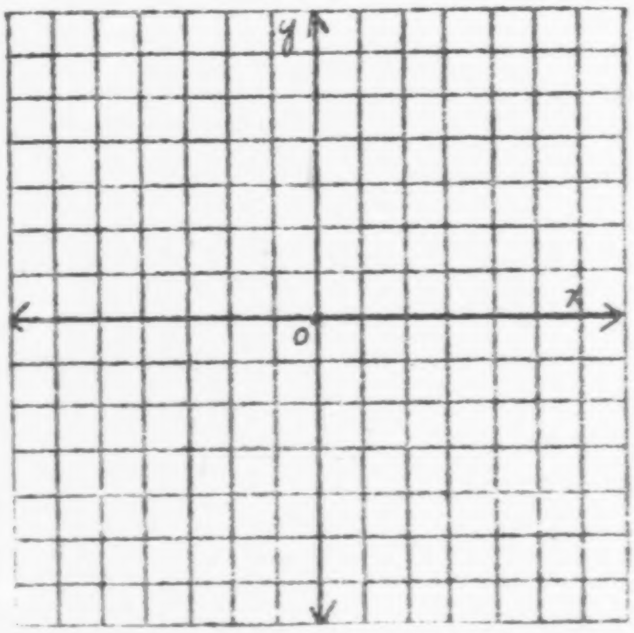
16. ____________________

17. ____________________

18. ____________________

19. ____________________

20.



$x - 3y = 7$

x			
y			

21. ____________________

22. ____________________

23. ____________________

24. ____________________

25. ____________________

26. ____________________

27. ____________________

28. ____________________

29. ______________________

30. ______________________

31. ______________________

32. ______________________

33. ______________________

34. ______________________

35. ______________________

36. ______________________

37. ______________________

38. ______________________

UNIT I

Systems of Linear Open Sentences

PART II
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on answer sheet. Do not spend too much time on any one problem.

1. Graph the linear equations $3x - 2y = -4$ and $x + 2y = 12$ on the grid provided.

2. The common solution of $3x - 2y = -4$ and $x + 2y = 12$ is ______________. (Use the graph in Problem 1.)

In Problems 3-6, solve the given systems of equations.

3. $2x - 3y = -4$
   $4x - 3y = -6$

4. $2a + 5b = 18$
   $3a + 4b = 27$

5. $\frac{x}{4} - \frac{y}{6} = 0$
   $\frac{3x}{8} + \frac{5y}{12} = -4$

6. $x + 2y = 5$
   $x = 3y$

In Problems 7 and 8, evaluate the determinant.

7. $\begin{vmatrix} 4 & -3 \\ 2 & 10 \end{vmatrix}$

8. $\begin{vmatrix} -2 & 2 \\ 5 & -5 \end{vmatrix}$

Problems 9 and 10 refer to solving the system of equations $\begin{aligned} 3x - 4y &= 2 \\ 5x + 2y &= 12 \end{aligned}$ by determinants.

9. The numerator determinant used in solving for x is:

A. $\begin{vmatrix} 2 & -4 \\ 12 & 2 \end{vmatrix}$ B. $\begin{vmatrix} 2 & 12 \\ 5 & 2 \end{vmatrix}$ C. $\begin{vmatrix} 3 & -4 \\ 5 & 2 \end{vmatrix}$

D. $\begin{vmatrix} 2 & 2 \\ 12 & 12 \end{vmatrix}$ E. $\begin{vmatrix} -4 & 2 \\ 2 & 12 \end{vmatrix}$

10. The denominator determinant used in solving for y is:

A. $\begin{vmatrix} 3 & 2 \\ 5 & 12 \end{vmatrix}$ B. $\begin{vmatrix} 2 & -4 \\ 12 & 2 \end{vmatrix}$ C. $\begin{vmatrix} -4 & 3 \\ 2 & 5 \end{vmatrix}$

D. $\begin{vmatrix} 3 & -4 \\ 5 & 2 \end{vmatrix}$ E. $\begin{vmatrix} 2 & 12 \\ 12 & 2 \end{vmatrix}$

11. Evaluate the following determinant:

$$\begin{vmatrix} 1 & 5 & -2 \\ 3 & -1 & 4 \\ 1 & 0 & 6 \end{vmatrix}$$

12. Sketch the graph of the linear inequality $x + y \geq 1$.

13. Graph the common solution of the linear inequalities:

$y > 4x + 1$ and $2y + 4x \leq 12$

UNIT I

Systems of Linear Open Sentences

PART II
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on answer sheet. Do not spend too much time on any one problem.

1. Graph the linear equations $4x - y = 5$ and $2x + 5y = -3$ on the grid provided.

2. The common solution of $4x - y = 5$ and $2x + 5y = -3$ is ______________. (Use the graph in Problem 1.)

In Problems 3-6 solve the given systems of equations.

3. $$\begin{aligned} x - 3y &= 6 \\ x - y &= 20 \end{aligned}$$

4. $$\begin{aligned} 9s - 8t &= 1 \\ 6s + 12t &= 5 \end{aligned}$$

5. $$\begin{aligned} \frac{x}{2} + \frac{y}{3} &= 2 \\ \frac{x}{3} + \frac{y}{9} &= 1 \end{aligned}$$

6. $$\begin{aligned} x - y &= 1 \\ y &= 2x + 1 \end{aligned}$$

In Problems 7 and 8 evaluate the determinant.

7. $\begin{vmatrix} 2 & -1 \\ -10 & -5 \end{vmatrix}$

8. $\begin{vmatrix} 6 & 3 \\ \frac{5}{3} & \frac{1}{2} \end{vmatrix}$

Problems 9 and 10 refer to solving the system of equations $\begin{aligned} x - 2y &= 5 \\ 5x + 5y &= 2 \end{aligned}$

9. The denominator determinant used in solving for x is:

A. $\begin{vmatrix} 5 & -2 \\ 2 & 5 \end{vmatrix}$ B. $\begin{vmatrix} 1 & -2 \\ 5 & 5 \end{vmatrix}$ C. $\begin{vmatrix} 5 & -2 \\ 5 & 5 \end{vmatrix}$

D. $\begin{vmatrix} 1 & 5 \\ 5 & 2 \end{vmatrix}$ E. None of these.

10. The numerator determinant used in solving for y is:

A. $\begin{vmatrix} 1 & -2 \\ 5 & 5 \end{vmatrix}$ B. $\begin{vmatrix} 0 & -2 \\ 5 & 5 \end{vmatrix}$ C. $\begin{vmatrix} 0 & 5 \\ 5 & 2 \end{vmatrix}$

D. $\begin{vmatrix} 1 & 5 \\ 5 & 2 \end{vmatrix}$ E. None of these.

11. Evaluate the following determinant:

$$\begin{vmatrix} 3 & 0 & 5 \\ 2 & 1 & 1 \\ -2 & 6 & -2 \end{vmatrix}$$

12. Sketch the graph of the linear inequality $2x - 2y \leq 6$.

13. Graph the common solution of the linear inequalities $y \leq 3x + 2$ and $9x + 3y < 6$.

UNIT I

Systems of Linear Open Sentences

PART II
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Graph the linear equations $2x + y = 3$ and $x - 2y = 4$ on the grid provided.

2. The common solution $2x + y = 3$ and $x - 2y = 4$ is ____________________. (Use the graph in Problem 1.)

In Problems 3-6 solve the given systems of equations.

3. $$\begin{aligned} 8x - y &= 29 \\ 2x + y &= 11 \end{aligned}$$

4. $$\begin{aligned} 9x - 8y &= 1 \\ 6x + 12y &= 5 \end{aligned}$$

5. $$\begin{aligned} \frac{1}{3}x + y &= 7 \\ x - 6y &= 2 \end{aligned}$$

6. $$\begin{aligned} 4r - 2s &= 3 \\ s &= 1r - 1.5 \end{aligned}$$

In Problems 7 and 8, evaluate the determinant.

7. $\begin{vmatrix} 3 & 6 \\ 5 & -2 \end{vmatrix}$

8. $\begin{vmatrix} 4 & 3 \\ 1 & -5 \end{vmatrix}$

Problems 9 and 10 refer to solving the system of equations: $\begin{aligned} 2x - y &= 7 \\ -3x + 2y &= 2 \end{aligned}$ by determinant.

9. The numerator determinant used in solving for x is:

A. $\begin{vmatrix} 2 & -1 \\ -3 & 2 \end{vmatrix}$ B. $\begin{vmatrix} 2 & 7 \\ -3 & 2 \end{vmatrix}$ C. $\begin{vmatrix} 7 & 2 \\ 2 & -3 \end{vmatrix}$

D. $\begin{vmatrix} 7 & -1 \\ 2 & 2 \end{vmatrix}$ E. $\begin{vmatrix} 7 & 7 \\ 2 & 2 \end{vmatrix}$

10. The denominator determinant used in solving for y is:

A. $\begin{vmatrix} 2 & -1 \\ -3 & 2 \end{vmatrix}$ B. $\begin{vmatrix} 2 & 7 \\ -3 & 2 \end{vmatrix}$ C. $\begin{vmatrix} 7 & 2 \\ 2 & -3 \end{vmatrix}$

D. $\begin{vmatrix} 7 & -1 \\ 2 & 2 \end{vmatrix}$ E. $\begin{vmatrix} 7 & 7 \\ 2 & 2 \end{vmatrix}$

11. Evaluate the following determinant:

$$\begin{vmatrix} 2 & 4 & -3 \\ 5 & 6 & 0 \\ -1 & -4 & 2 \end{vmatrix}$$

12. Sketch the graph of the linear inequality $2x - y > 1$.

13. Graph the common solution of the linear inequalities: $2x + 3y \leq 6$ and $3y - 4x < -12$.

UNIT I

Systems of Linear Open Sentences

PART II
Test D

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Graph the linear equations $x - y = 2$ and $2x + 3y = 9$ on the grid provided.

2. The common solution of $x-y = 2$ and $2x + 3y = 9$ is ____________________. (Use the graph in Problem 1.)

In Problems 3-6, solve the given system of equations.

3. $$\begin{aligned} 3x + y &= 4 \\ 2x - y &= 6 \end{aligned}$$

4. $$\begin{aligned} 8x + 15y &= 23 \\ 7x + 10y &= 17 \end{aligned}$$

5. $$\begin{aligned} \frac{1}{5}x + y &= 2 \\ x - 4y &= 1 \end{aligned}$$

6. $$\begin{aligned} 2x + y &= 1 \\ x &= 8 - 3y \end{aligned}$$

In Problems 7 and 8, evaluate the determinant.

7. $$\begin{vmatrix} 4 & 7 \\ 2 & -3 \end{vmatrix}$$

8. $$\begin{vmatrix} 6 & 1 \\ 4 & 5 \end{vmatrix}$$

Problems 9 and 10 refer to solving the system of equations $\begin{aligned} 3x - y &= 9 \\ -4x + 3y &= 6 \end{aligned}$ by determinants.

9. The denominator used in solving for x is:

A. $\begin{vmatrix} 3 & 9 \\ -4 & 6 \end{vmatrix}$

B. $\begin{vmatrix} 9 & -1 \\ 6 & 3 \end{vmatrix}$

C. $\begin{vmatrix} -3 & +1 \\ +4 & +3 \end{vmatrix}$

D. $\begin{vmatrix} 3 & -1 \\ -4 & 3 \end{vmatrix}$

E. None of the above.

10. The numerator used in solving for y is:

A. $\begin{vmatrix} 3 & 9 \\ -4 & 6 \end{vmatrix}$

C. $\begin{vmatrix} -3 & 1 \\ 4 & +3 \end{vmatrix}$

B. $\begin{vmatrix} 9 & -1 \\ 6 & 3 \end{vmatrix}$

D. $\begin{vmatrix} 3 & -1 \\ -4 & 3 \end{vmatrix}$

E. None of the above

11. Evaluate the following determinant:

$$\begin{vmatrix} 3 & 2 & -4 \\ 1 & 4 & 0 \\ 2 & -5 & 3 \end{vmatrix}$$

12. Sketch the graph of the linear inequality $3x - y < 2$.

13. Graph the common solution of the linear inequalities $3x + 4y \geq 12$ and $-2x + 3y \leq 6$.

UNIT I

Systems of Linear Open Sentences

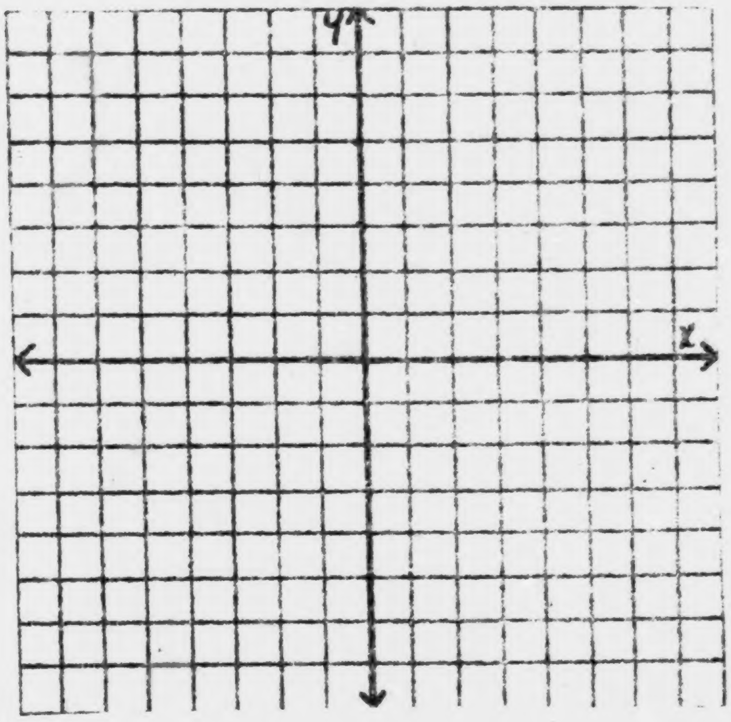
PART II
Test A B C D

NAME ______________________ SECTION ______________

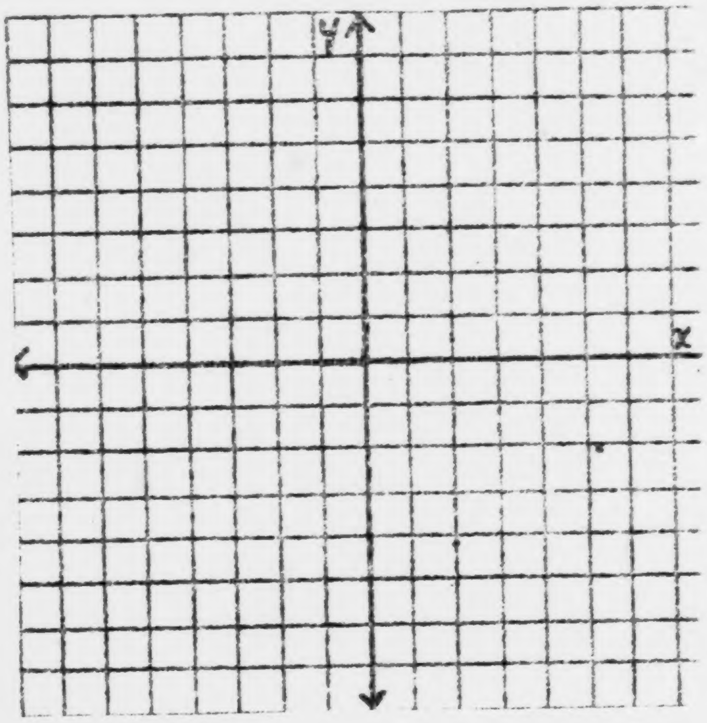
TEACHER ______________________ DATE ______________

SCORE ______________________ PERIOD ______________

1.



12.



2. ______________________

3. ______________________

4. ______________________

5. ______________________

6. ______________________

7. ______________________

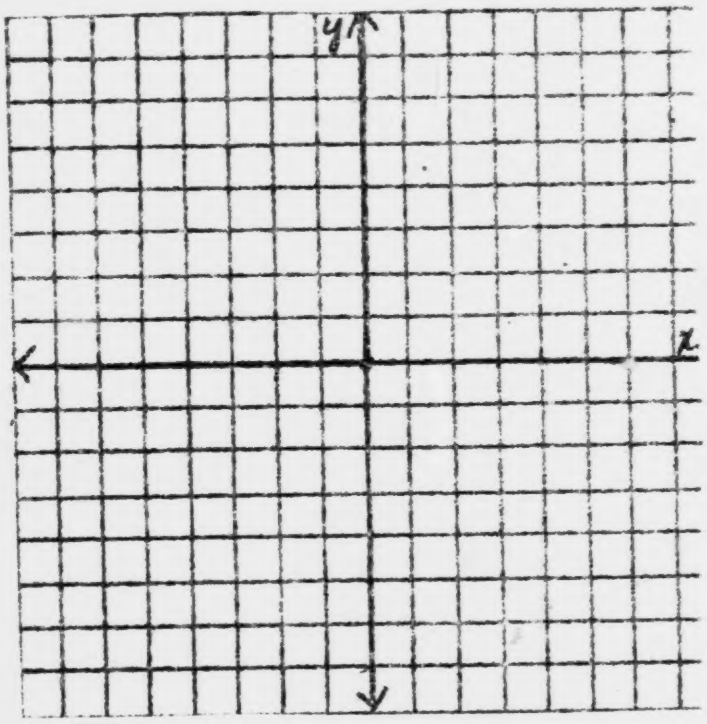
8. ______________________

9. ______________________

10. ______________________

11. ______________________

13.



UNIT II ## Polynomials and Factoring Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. For a and b real numbers, and for m and n positive integers, which of the following statements is true?

   I. $b^m \cdot b^n = b^{m+n}$

   II. $(ab)^m = ab^m$

   III. $(b^m)^n = b^m + n$

   IV. $(\frac{a}{b})^m = \frac{a^m}{b^m}$, $b \neq 0$

   A. All are correct.

   B. Only I and IV are correct.

   C. Only I, II, and IV are correct.

   D. None are correct.

2. SIMPLIFY: $(-23)^0$

3. SIMPLIFY: $3 + (596)^0$

4. SIMPLIFY: $x + y^0$

5. SIMPLIFY: $(x + y)^0$

6. SIMPLIFY: $(x^2)^3$

7. SIMPLIFY: $(-\frac{3}{4})^2$

8. SIMPLIFY: $(ab)^4$

9. SIMPLIFY: $(2a)^3$

10. SIMPLIFY: $\frac{x^{15}}{x^5}$

11. SIMPLIFY: $\frac{y^5}{y^9}$

12. SIMPLIFY: $c^4 \cdot c$

13. SIMPLIFY: $d^4 \cdot d^2$

14. SIMPLIFY: $(4a^4)(-3a^5)$

15. SIMPLIFY: $(3a^2b)(15a^3bc^2)$

16. SIMPLIFY: $(-2a^2b)^2(-ab^3c^2)$

17. SIMPLIFY: $\dfrac{72a^5b^3c^4}{-12a^3bc^3}$

18. SIMPLIFY: $\dfrac{-42x^4y^2z^3}{-21x^4y^5}$

19. SIMPLIFY: $\left(\dfrac{12x^2y^3z^4}{6xy^3z}\right)^2$

20. SIMPLIFY: $(-2x)^3(3x^2) - (-2x^2)^2(3x)$

21. SIMPLIFY: $3^{2a} \cdot 3^{3a}$

22. SIMPLIFY: $\dfrac{a^{x+2}}{a^{x+1}}$

23. COMPLETION: $a(b + c) = ab + ac$ is an example of the ____________ law.

24. MULTIPLY: $-3x^2(2x^3 - 3y + 2)$

25. MULTIPLY: $(3x + 5)(2x - 7)$

26. Which of the following is not true?

A. $(a + b)^2 = a^2 + 2ab + b^2$ C. $(a - b)^2 = a^2 - 2ab + b^2$

B. $(a + b)(a - b) = a^2 - b^2$ D. $(a + b)^2 = a^2 + b^2$

27. MULTIPLY: $(2x + y)(2x - y)$

28. MULTIPLY: $(3x + y)^2$

29. MULTIPLY:

$$\begin{array}{l} x^2 - x + 1 \\ \underline{x + 1\quad} \end{array}$$

30. Write the set of all factors of the number 12.

31. Write the GCF of 24 and 36.

32. Write the LCM of 18 and 24.

33. FACTOR COMPLETELY: $4x^2 - 9y^2$

34. FACTOR COMPLETELY: $4x^2 + 4xy + y^2$

35. FACTOR COMPLETELY: $4x^2y + 10xy - 4y$

36. FACTOR COMPLETELY: $x^2 - 11x + 28$

37. FACTOR COMPLETELY: $x^2 - 4x + 3$

38. FACTOR COMPLETELY: $x^2 + 4x - 12$

39. FACTOR COMPLETELY: $6x^2 + 13x + 5$

40. FACTOR COMPLETELY: $xy + x + ay + a$

41. FACTOR COMPLETELY: $x^3 + 8$

42. FACTOR COMPLETELY: $8x^3 - 27y^3$

43. FACTOR COMPLETELY: $2x^2 - 50$

44. FACTOR COMPLETELY: $3x^3y + 3y$

45. TRUE or FALSE: If $ab = 0$, then $a = 0$.

46. The solution set of $x^2 + 6x + 5 = 0$ is:

A. {3, -2}
B. { 5, 1 }
C. { -3, -2 }
D. { -5, -1}
E. None of these.

47. The solution set of $x^3 + x^2 = 6x$ is:

A. {2, -3 }
B. {0, -2, 3 }
C. {0, 2, 3 }
D. {0, 2, -3}
E. {0, -3, -2}

48. TRUE or FALSE: $\frac{15x^2y + 10xy^2 + 5x}{5y} = 3x^2 + 2xy + \frac{x}{y}$

49. DIVIDE: $x + 2 \overline{\big)\, x^3 + 5x - 4}$

UNIT II

Polynomials and Factoring

Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. For a and b real numbers, and for m and n positive integers, which of the following statements is true?

   I. $(b^m)^n = b^{mn}$

   II. $(ab)^m = a^m b^m$

   III. $b^m \cdot b^n = b^{mn}$

   IV. $(\frac{a}{b})^m = \frac{a^m}{b}$, $b \neq 0$

   A. All are correct.

   B. Only I and II are correct.

   C. I, II, and IV are correct.

   D. None are correct.

2. SIMPLIFY: $(-15)^0$

3. SIMPLIFY: $5 + (34)^0$

4. SIMPLIFY: $a^0 + b$

5. SIMPLIFY: $(a - 2b)^0$

6. SIMPLIFY: $(a^5)^3$

7. SIMPLIFY: $(-\frac{1}{2})^3$

8. SIMPLIFY: $(xy)^5$

9. SIMPLIFY: $(3a)^2$

10. SIMPLIFY: $\frac{m^{20}}{m^4}$

11. SIMPLIFY: $\frac{x^8}{x^{11}}$

12. SIMPLIFY: $x^8 \cdot x$

13. SIMPLIFY: $m^{18} \cdot m^{8}$

14. SIMPLIFY: $(3b^{2})(-2b^{4})$

15. SIMPLIFY: $(7x^{2}y)(-2x^{5}yz^{3})$

16. SIMPLIFY: $(-3m^{3}n)^{2}(-mnp^{2})$

17. SIMPLIFY: $\dfrac{48a^{6}b^{4}c^{4}}{-16a^{4}b\,c^{3}}$

18. SIMPLIFY: $\dfrac{-18a^{7}b^{4}c^{4}d^{3}}{12a^{7}b^{5}c^{3}}$

19. SIMPLIFY: $\left(\dfrac{24x^{2}y\,z^{3}}{6xy^{2}}\right)^{2}$

20. SIMPLIFY: $(-3a)^{3}(2a^{2}) - (-2a^{3})^{2}(3a)$

21. SIMPLIFY: $(5^{2m})(5^{4m})$

22. SIMPLIFY: $\dfrac{b^{3-x}}{b^{2-x}}$

23. COMPLETION: $(b+c)a = ba + ca$ is an example of the ________________ law.

24. MULTIPLY: $(-2a^{3})(2a^{2} - 4b + 1)$

25. MULTIPLY: $(2x + 7)(3x - 1)$

26. Which of the following is not true?

A. $(a + b)^{2} = a^{2} + b^{2}$

B. $(a + b)(a - b) = a^{2} - b^{2}$

C. $(a - b)^{2} = a^{2} - 2ab + b^{2}$

D. $(a + b)^{2} = a^{2} + 2ab + b^{2}$

27. MULTIPLY: $(3x - y)(x + y)$

28. MULTIPLY: $(2x + 3y)^{2}$

29. MULTIPLY:

$$\begin{array}{l} a^{2} + a + 1 \\ \underline{a - 1\qquad\quad} \end{array}$$

30. Write the set of all factors of the number 15.

31. Write the GCF of 16 and 24.

32. Write the LCM of 16 and 20.

33. FACTOR COMPLETELY: $16x^2 - 9y^2$

34. FACTOR COMPLETELY: $9x^2 + 6xy + y^2$

35. FACTOR COMPLETELY: $15x^3y + 30x^2y - 5y$

36. FACTOR COMPLETELY: $x^2 - 12x + 32$

37. FACTOR COMPLETELY: $x^2 - 7x + 6$

38. FACTOR COMPLETELY: $x^2 + 4x - 21$

39. FACTOR COMPLETELY: $10x^2 + 17x + 3$

40. FACTOR COMPLETELY: $3a^2 + 3a + 2ax + 2x$

41. FACTOR COMPLETELY: $x^3 + 27$

42. FACTOR COMPLETELY: $27x^3 - 8y^3$

43. FACTOR COMPLETELY: $3x^2 - 108$

44. FACTOR COMPLETELY: $2x^3y + 16y$

45. TRUE or FALSE: If $xy = 0$, then $y = 0$.

46. The solution set of $x^2 - 5x - 14 = 0$ is:

A. $\{7, -2\}$ C. $\{2, -7\}$

B. $\{-14, 1\}$ D. None of these.

47. The solution set of $x^3 - 7x^2 = -6x$ is:

A. $\{6, 1)$ C. $\{0, -1, -6\}$

B. $\{0, 6, 1\}$ D. None of these.

48. TRUE or FALSE: $\dfrac{12a^3 - 9a^2 + 3a}{3a^2} = 4a - 3 + \dfrac{1}{a}$

49. DIVIDE: $x + 3 \overline{\big)\, x^3 + x - 9}$

UNIT II Polynomials and Factoring Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. For a and b real numbers, and for m and n positive integers, which of the following statements is true?

   I. $b^m \cdot b^n = b^{m+n}$

   II. $(b^m)^n = b^{mn}$

   III. $(ab)^m = a^m b^m$

   IV. $(\frac{a}{b})^m = \frac{a^m}{b^m}$, $b \neq 0$

   A. All are correct.

   B. Only I and III are correct.

   C. Only II, III and IV are correct.

   D. None are correct.

2. SIMPLIFY: $(-3)^0$

3. SIMPLIFY: $(23)^0 - 6$

4. SIMPLIFY: $(2a - b^0)$

5. SIMPLIFY: $(3a + b)^0$

6. SIMPLIFY: $(a^3)^4$

7. SIMPLIFY: $(-\frac{1}{3})^2$

8. SIMPLIFY: $(rs)^5$

9. SIMPLIFY: $(-2m)^3$

10. SIMPLIFY: $\frac{x^{14}}{x^3}$

11. SIMPLIFY: $\frac{a^5}{a^7}$

12. SIMPLIFY: $y^4 \cdot y$

13. SIMPLIFY: $k^{12} \cdot k^{8}$

14. SIMPLIFY: $(4x^{3})(-3x^{4})$

15. SIMPLIFY: $(-6a^{2}b)(3ab^{4}c^{7})$

16. SIMPLIFY: $(-r^{4}s)^{3}(2rs^{2}t)$

17. SIMPLIFY: $\frac{-36x^{3}y^{7}z^{2}}{12x^{2}y^{4}z}$

18. SIMPLIFY: $\frac{24m^{3}n^{5}p^{9}q}{-4m^{8}n^{5}p}$

19. SIMPLIFY: $\left(\frac{3a^{3}b^{2}c}{-2ab^{4}}\right)^{3}$

20. SIMPLIFY: $(-2x)^{4}(3x)^{2} - (-3x^{2})(4x)$

21. SIMPLIFY: $(3^{m})(3^{4m})$

22. SIMPLIFY: $\frac{b^{4-x}}{b^{2-x}}$

23. COMPLETION: $a(b + c) = ab + ac$ is an example of the________________ law.

24. MULTIPLY: $(-3a^{2})(4a^{3} - 3b - 2)$

25. MULTIPLY: $(4y + 3)(2y - 5)$

26. Which of the following is not true?

A. $(a - b)^{2} = a^{2} - 2ab + b^{2}$

B. $(a - b)(a + b) = a^{2} - b^{2}$

C. $(a - b)^{2} = a^{2} - b^{2}$

D. $(a + b)^{2} = a^{2} + b^{2}$

27. MULTIPLY: $(2m + n)(m - n)$

28. MULTIPLY: $(3a - 4b)^{2}$

29. MULTIPLY:

$$\begin{array}{r} x^{2} - x + 1 \\ x + 1 \\ \hline \end{array}$$

30. Write the set of all factors of the number 18.

31. Write the GCF of 24 and 32.

32. Write the LCM of 10 and 24.

33. FACTOR COMPLETELY: $16a^2 - 9b^2$

34. FACTOR COMPLETELY: $4r^2 + 4rs + s^2$

35. FACTOR COMPLETELY: $15m^3n + 30m^2n - 5n$

36. FACTOR COMPLETELY: $c^2 - 11c + 28$

37. FACTOR COMPLETELY: $y^2 - 7y + 6$

38. FACTOR COMPLETELY: $z^2 + 4z - 12$

39. FACTOR COMPLETELY: $10y^2 + 17y + 3$

40. FACTOR COMPLETELY: $ab + a + xb + x$

41. FACTOR COMPLETELY: $a^3 + 27$

42. FACTOR COMPLETELY: $8m^3 - 27n^3$

43. FACTOR COMPLETELY: $3y^2 - 108$

44. FACTOR COMPLETELY: $3b^3c + 3c$

45. TRUE or FALSE: If $xy = 0$, then $y = 0$.

46. The solution set of $y^2 - 5y - 14 = 0$ is:

A. $\{2, -7\}$
B. $\{-14, 2\}$
C. $\{7, -2\}$
D. None of these.

47. The solution set of $a^3 - 7a^2 = -6a$ is:

A. $\{0, 6, 1\}$
B. $\{6, 1\}$
C. $\{0, -1, -6\}$
D. None of these.

48. TRUE or FALSE: $\dfrac{9x^3 - 12x^2 + 3x}{3x^2} = 3x - 4 + \dfrac{1}{x}$

49. DIVIDE: $a + 3\,\overline{)\,a^3 + a - 9}$

UNIT II **Polynomials and Factoring** Test D

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. For a and b real numbers, and for m and n positive integers, which of the following statements is true?

   I. $(ab)^m = a^m b^m$

   II. $a^m \cdot a^n = a^{m+n}$

   III. $(\frac{a}{b})^m = \frac{a^m}{b}$, $b \neq 0$

   IV. $b^m \cdot a^n = (ab)^{mn}$

   A. Only III and IV are correct.

   B. Only I and II are correct.

   C. All are correct.

   D. None are correct.

2. SIMPLIFY: $(-15)^0$

3. SIMPLIFY: $2 + (450)^0$

4. SIMPLIFY: $x^0 + y$

5. SIMPLIFY: $(x - y)^0$

6. SIMPLIFY: $(w^3)^2$

7. SIMPLIFY: $(-\frac{4}{3})^2$

8. SIMPLIFY: $(xz)^4$

9. SIMPLIFY: $(3a)^3$

10. SIMPLIFY: $\frac{x^{14}}{x^7}$

11. SIMPLIFY: $\frac{a^4}{a^7}$

12. SIMPLIFY: $R^6 \cdot R$

13. SIMPLIFY: $c^{8} \cdot c^{3}$

14. SIMPLIFY: $(3a^{3})(-6a^{7})$

15. SIMPLIFY: $(7a^{2}b)(4a^{3}b\,c^{2})$

16. SIMPLIFY: $(-3a\,b^{2})^{2}(-a\,b^{3}c^{2})$

17. SIMPLIFY: $\dfrac{35x^{5}\,b^{3}\,c^{4}}{-7\,x^{3}\,b^{2}\,c^{2}}$

18. SIMPLIFY: $\dfrac{-84y^{4}z^{3}w^{2}}{-21y^{4}w^{7}}$

19. SIMPLIFY: $\left(\dfrac{8a^{2}b^{3}c^{5}}{3a\,b^{4}c2}\right)^{2}$

20. SIMPLIFY: $(-5x)^{2}(3x^{3}) - (-5x)(-3x^{2})^{3}$

21. SIMPLIFY: $5^{2a} \cdot 5^{5a}$

22. SIMPLIFY: $\dfrac{b^{x+3}}{b^{x+1}}$

23. COMPLETION: $x(y + z) = xy + xz$ is an example of the ______________ law.

24. MULTIPLY: $-5x^{3}(2x^{2} - 2y + 3)$

25. MULTIPLY: $(5x + 4)(2x - 3)$

26. Which of the following is not true?

A. $(b + c)^{2} = b^{2} + c^{2}$

B. $(b + c)^{2} = b^{2} + 2bc + c^{2}$

C. $(b + c)(b - c) = b^{2} - c^{2}$

D. $(b - c)^{2} = b^{2} - 2bc + c^{2}$

27. MULTIPLY: $(3x + y)(3x + y)$

28. MULTIPLY: $(3a + b)^{2}$

29. MULTIPLY:

$$\begin{array}{l} x^{2} + x - 1 \\ \underline{x - 1\qquad} \end{array}$$

30. Write the set of all factors of the number 16.

31. Write the GCF of 24 and 48.

32. Write the LCM of 16 and 36.

33. FACTOR COMPLETELY: $4a^2 - 9d^2$

34. FACTOR COMPLETELY: $9r^2 + 6rs + s^2$

35. FACTOR COMPLETELY: $4x^2y + 10xy - 4y$

36. FACTOR COMPLETELY: $w^2 - 12w + 32$

37. FACTOR COMPLETELY: $a^2 - 4a + 3$

38. FACTOR COMPLETELY: $b^2 + 4b - 21$

39. FACTOR COMPLETELY: $6r^2 + 13r + 5$

40. FACTOR COMPLETELY: $3x^2 + 3x + 2xy + 2y$

41. FACTOR COMPLETELY: $a^3 + 8$

42. FACTOR COMPLETELY: $8c^3 - 27d^3$

43. FACTOR COMPLETELY: $2z^2 - 50$

44. FACTOR COMPLETELY: $2a^3b + 16b$

45. TRUE or FALSE: If $xy = 0$, then $y = 0$.

46. The solution set of $a^2 + 6a + 5 = 0$ is:

A. $\{3, -2\}$ C. $\{-3, -2\}$

B. $\{5, 1\}$ D. $\{5, -1\}$

E. None of these.

47. The solution set of $a^3 + a^2 = 6a$ is:

A. $\{2, -3\}$ C. $\{0, 2, 3\}$

B. $\{0, 2, -3\}$ D. $\{0, -2, 3\}$

E. $\{0, -3, -2\}$

48. TRUE or FALSE: $\frac{15a^2b + 10ab^2 + 5b}{5a} = 3ab + 2b^2 + \frac{b}{a}$

49. DIVIDE: $a + 2 \overline{\big)\, a^3 + 5a - 4}$

UNIT II

Polynomials and Factoring

Test A B C D

NAME ______________________________ SECTION ____________

TEACHER ____________________________ DATE ____________

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UNIT III

Rational Numbers and Expressions

PART I
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1 through 9, write each expression involving negative exponents with positive exponents only.

1. 5^{-3}

2. $\frac{1}{a^{-2}}$

3. $(\frac{1}{a})^{-3}$

4. $5b^{-3}$

5. $(2a)^{-2}$

6. $\frac{r^2}{t^{-3}}$

7. x^2y^{-3}

8. $5a^{-2}b^{-3}$

9. $\frac{6x^2y^{-3}}{d^{-4}}$

10. TRUE or FALSE: The "law" of exponents $(a^m)^n = a^{mn}$ does not hold for negative integral exponents m and n.

11. Which one of the following expressions has no value?

A. $0 \div 8$

B. $10 \div 1$

C. $5 \div 0$

D. $\frac{0}{7}$

12. Consider the following numbers:

I. $\frac{3}{4}$

II. 2

III. -3

IV. 0

V. 1.2

Which of the following statements is true?

A. Only I is a rational number.

B. Only I and V are rational numbers.

C. All are rational numbers.

D. None is a rational number.

In Problems 13 through 16, state what replacements of the variable make the rational expression undefined.

13. $\frac{5 + x}{x}$

14. $\frac{a + 3}{2a - 3}$

15. $\frac{(b + 2)}{(b + 1)(b - 3)}$

16. $\frac{2t + 7}{t^2 - 16}$

In Problems 17 through 20, reduce each rational expression to lowest terms.

17. $\frac{ax^2y}{ax^2z}$

18. $\frac{c(x + y)^2}{d(x + y)}$

19. $\frac{x^2 - y^2}{x^2 + 2xy + y^2}$

20. $\frac{x^2 - 5x}{x^2 - 7x + 10}$

21. MULTIPLY: $\frac{15y^3}{3a^2} \cdot \frac{27a}{5y}$

22. MULTIPLY: $\frac{a^2 - b^2}{(a + b)^2} \cdot \frac{3a + 3b}{6a(a-b)}$

23. MULTIPLY: $\frac{a^2 - 1}{a^2 + 2a + 1} \cdot \frac{1 + a}{1 - a}$

24. DIVIDE: $\dfrac{5a}{12yz^2} \div \dfrac{15a^2}{18y^2z^2}$

25. DIVIDE: $\dfrac{8a^2}{a^2 - 16} \div \dfrac{4a}{a - 4}$

26. DIVIDE: $\dfrac{2a - 8}{a^2 - 4} \div \dfrac{a - 4}{a^2 + 6a + 8}$

27. Write .12 as the quotient of two integers.

28. Write $\frac{3}{4}$ as a decimal.

29. Write $\frac{2}{3}$ as a decimal.

30. Write .111... as the quotient of two integers.

31. Write $\overline{.21}$ as the quotient of two integers.

UNIT III

Rational Numbers and Expressions

PART I
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1-9 write each expression involving negative exponents with positive exponents only.

1. 4^{-5}
2. $\frac{1}{a^{-3}}$
3. $(\frac{1}{x})^{-2}$
4. $6b^{-4}$
5. $(3a)^{-3}$
6. $\frac{a^2}{b^{-3}}$
7. x^3y^{-2}
8. $7x^{-3}y^{-5}$
9. $\frac{5a^2b^{-3}}{c^{-6}}$
10. TRUE or FALSE: The "law" of exponents $(a^m)^n = a^{mn}$ holds for negative integral exponents m and n.
11. Which one of the following expressions has no value?

A. $6 \div 0$

B. $0 \div 8$

C. $6 \div 1$

D. $\frac{0}{5}$

12. Consider the following numbers:

I. $\frac{7}{8}$

II. 3

III. -7

IV. 0

V. 2.3

Which of the following statements are true?

A. Only I is a rational number.

B. Only II and III are rational numbers.

C. All are rational numbers.

D. None is a rational number.

In Problems 13-16 state what replacements of the variable make the rational expression undefined.

13. $\frac{x - 7}{x}$

14. $\frac{a + 3}{5a - 4}$

15. $\frac{x + 6}{(x + 2)(x - 7)}$

16. $\frac{3y + 7}{y^2 - 81}$

In Problems 17-20 reduce each rational expression to lowest terms.

17. $\frac{b x^2 y}{b x^2 y^3}$

18. $\frac{a(x - y)^2}{b(x - y)}$

19. $\frac{x^2 - y^2}{x^2 - 2xy + y^2}$

20. $\frac{x^2 - 3x}{x^2 + 2x - 15}$

21. MULTIPLY: $\frac{12y^5}{6a^3} \cdot \frac{18a}{4y^3}$

22. MULTIPLY: $\frac{a^2 - c^2}{(a + c)^2} \cdot \frac{3a + 3c}{9a\,(a - c)}$

23. MULTIPLY: $\frac{a^2 - 4}{a^2 + 2a + 1} \cdot \frac{(1 + a)^2}{2 - a}$

24. DIVIDE: $\frac{9a^2}{26y^3z^3} \div \frac{3a}{13y\,z^2}$

25. DIVIDE: $\frac{16x^2}{x^2 - 25} \div \frac{8x}{x + 5}$

26. DIVIDE: $\frac{3a - 6}{a^2 - 49} \div \frac{a - 2}{a^2 + 10a + 21}$

27. Write .35 as the quotient of two integers.

28. Write $\frac{2}{5}$ as a decimal.

29. Write $\frac{1}{9}$ as a decimal.

30. Write .222... as a quotient of two integers.

31. Write $\overline{.26}$ as a quotient of two integers.

UNIT III **Rational Numbers and Expressions** PART I
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1-9 write each expression involving negative exponents with positive exponents only.

1. $10a^{-5}$

2. $\frac{4}{a^{-1}}$

3. $\frac{x^2}{y^{-4}}$

4. $(\frac{1}{y})^{-6}$

5. 5^{-3}

6. $15\,x^3y^{-3}$

7. $10x^{-4}y^{-6}$

8. $(4x)^{-3}$

9. $\frac{4a^{-5}}{bc^{-7}}$

10. TRUE or FALSE: The "law" of exponents $(a^m)^n = a^{mn}$ holds for negative integral exponents m and n.

11. Which one of the following expressions has no value?

A. $\frac{0}{10}$

B. $\frac{10}{0}$

C. $10 \div 1$

D. $0 \div 1$

12. Consider the following numbers:

I. $\frac{5}{6}$

II. 5

III. $-\frac{4}{7}$

IV. 7.9

V. 0

A. Only I is a rational number.

B. Only I and III are rational numbers.

C. Only I, III, IV are rational numbers.

D. All are rational numbers.

E. None is a rational number.

In Problems 13-16 state what replacements of the variable make the rational expression undefined.

13. $\frac{x}{5 + x}$

14. $\frac{x + 6}{3x - 1}$

15. $\frac{x + 9}{(x + 5)(x - 5)}$

16. $\frac{y}{y^2 - 64}$

In Problems 17 through 20, reduce each rational expression to lowest terms.

17. $\frac{a b c^3}{a^5 b c^3}$

18. $\frac{x (a + b)^3}{y (a + b)}$

19. $\frac{x^2 - 16}{x^2 + 8x + 16}$

20. $\frac{y^2 - 7y}{y^2 - 5y - 14}$

21. MULTIPLY: $\frac{30y^5}{7a^4} \cdot \frac{21a}{5y^3}$

22. MULTIPLY: $\frac{x^2 - y^2}{(x + y)^2} \cdot \frac{4x + 4y}{3x - 3y}$

23. MULTIPLY: $\frac{x^2 - 9}{x^2 + 2x + 1} \cdot \frac{1 + x}{3 - x}$

24. DIVIDE: $\frac{14x}{34y^2z^3} \div \frac{7x^3}{5y^3z}$

25. DIVIDE: $\frac{20a^2}{a^2 - 49} \div \frac{5a}{a + 7}$

26. DIVIDE: $\frac{5x - 15}{x^2 - 36} \div \frac{x - 3}{x^2 - 8x + 12}$

27. Write .27 as the quotient of two integers.

28. Write $\frac{3}{16}$ as a decimal.

29. Write $\frac{5}{6}$ as a decimal.

30. Write .555... as a quotient of two integers.

31. Write $.\overline{45}$ as a quotient of two integers.

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1-9 write each expression involving negative exponents with positive exponents only.

1. $5x^{-2}$
2. $\frac{10}{a^{-3}}$
3. $\frac{y^5}{x^{-3}}$
4. $(\frac{1}{z})^{-7}$
5. 2^{-4}
6. $20xy^{-4}$
7. $-5x^{-2}y^{-7}$
8. $(2x)^{-5}$
9. $\frac{6x^{-3}}{y^2z^{-4}}$
10. TRUE or FALSE: The "law" of exponents $(a^m)^n = a^{mn}$ holds for negative integral exponents m and n.
11. Which one of the following expressions has no value?

A. $16 \div 1$

B. $16 \div 0$

C. $\frac{1}{0}$

D. $0 \div 1$

12. Consider the following numbers:

I. 10.2

II. 7

III. $-\frac{1}{6}$

IV. $\frac{4}{7}$

V. 0

A. Only IV is a rational number.

B. Only III, IV are rational numbers.

C. Only I, III, IV are rational numbers.

D. All are rational numbers.

E. None is a rational number.

In Problems 13-16 state what replacements of the variable make the rational expression undefined.

13. $\frac{x - 5}{x}$

14. $\frac{x - 6}{3x + 1}$

15. $\frac{x + 6}{(x - 7)(x + 7)}$

16. $\frac{a}{100 - a^2}$

In Problems 17 through 20, reduce each rational expression to lowest terms.

17. $\frac{x^2 y^3 z}{x^5 y^3 z}$

18. $\frac{a(x + y)^5}{b(x + y)}$

19. $\frac{y^2 - 49}{y^2 - 14y + 49}$

20. $\frac{a^2 - 3a}{a^2 + 4a - 21}$

21. MULTIPLY: $\frac{25x^4}{7a^3} \cdot \frac{14a^5}{15x^3}$

22. MULTIPLY: $\frac{a^2 - 9}{(a + 3)^2} \cdot \frac{4a + 12}{3a + 9}$

23. MULTIPLY: $\frac{y^2 - 25}{y^2 - 10y + 25} \cdot \frac{1 + y}{5 - y}$

24. DIVIDE: $\frac{16x}{35x^2y^3} \div \frac{8x^3}{7xy^4}$

25. DIVIDE: $\frac{45x^3}{x^2 - 64} \div \frac{9x}{x + 8}$

26. DIVIDE: $\frac{4x - 32}{x^2 - 64} \div \frac{4x - 4}{x^2 - 10x + 16}$

27. Write .33 as the quotient of two integers.

28. Write $\frac{5}{8}$ as a decimal.

29. Write $\frac{2}{9}$ as a decimal.

30. Write .444... as a quotient of two integers.

31. Write $.\overline{36}$ as a quotient of two integers.

UNIT III

Rational Numbers and Expressions

PART I
Test A B C D

NAME________________________ SECTION__________

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UNIT III

Rational Numbers and Expressions

PART II
Test A

DIRECTIONS: Do not write on the test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem. Reduce all answers to lowest terms.

1. FIND THE LCM: $3xy^2, 6x^3y$
2. FIND THE LCM: $x^2 - 9, x^2 - 5x + 6$
3. ADD: $\frac{3a + b}{7} + \frac{2a - 3b}{7}$
4. SUBTRACT: $\frac{5a - 3b}{6} - \frac{5a - 4b}{4}$
5. COMBINE: $\frac{4}{ab^2} - \frac{7}{a^2b} + \frac{3}{ab}$
6. ADD: $\frac{3}{y + 2} + \frac{5}{y - 4}$
7. SUBTRACT: $\frac{y + 2}{y + 4} - \frac{y - 1}{y + 6}$
8. COMBINE: $\frac{a}{a - b} - \frac{b}{a + b} + \frac{a - 3}{a^2 - b^2}$
9. SIMPLIFY: $\dfrac{\frac{1}{2} + \frac{1}{3}}{\frac{1}{2} - \frac{1}{3}}$
10. SIMPLIFY: $\dfrac{\frac{1}{x} - 1}{x - x^2}$
11. SIMPLIFY: $\dfrac{2 + \frac{2}{y-1}}{\frac{2}{y-1}}$

12. SOLVE: $\frac{1}{2}x - \frac{1}{6}x = x - 16$

13. SOLVE: $\frac{x - 1}{2} - \frac{3x - 4}{2} = \frac{5x - 3}{2}$

14. SOLVE:

$$\frac{1}{3}x + \frac{1}{5}y = -\frac{1}{5}$$

$$\frac{2}{3}x - \frac{3}{4}y = -5$$

15. SOLVE: $\frac{10}{x} - 2 = \frac{5 - x}{4x}$

16. SOLVE: $\frac{2}{x^2 - 4} + \frac{1}{x + 2} - \frac{1}{2x - 4} = 0$

UNIT III

Rational Numbers and Expressions

PART II
Test B

DIRECTIONS: Do not write on the test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem. Reduce all answers to lowest terms.

1. FIND THE LCM: $4ab^2, \ 6a^3b$

2. FIND THE LCM: $x^2 - 4, \ x + 2, \ 2x - 4$

3. ADD: $\dfrac{2x - y}{6} + \dfrac{5x + 2y}{6}$

4. SUBTRACT: $\dfrac{3x - 5}{9} - \dfrac{2x + 7}{6}$

5. COMBINE: $\dfrac{5a}{4} - \dfrac{3a}{2} + \dfrac{7a}{8}$

6. ADD: $\dfrac{3}{x - 2} + \dfrac{2}{x + 5}$

7. SUBTRACT: $\dfrac{x + y}{x - y} - \dfrac{x - y}{x + y}$

8. COMBINE: $\dfrac{3}{x - 2} + \dfrac{3x}{x^2 - 4} - \dfrac{2x}{x^2 + 4x + 4}$

9. SIMPLIFY: $\dfrac{-\frac{9}{5} + 2}{-\frac{9}{5} + 1}$

10. SIMPLIFY: $\dfrac{x + y}{\frac{1}{x} + \frac{1}{y}}$

11. SIMPLIFY: $\dfrac{y + \frac{1}{y + 2}}{y + \frac{1}{y - 2}}$

12. SOLVE: $\frac{2}{3}n + \frac{3}{4}n = 17$

13. SOLVE: $\frac{3x + 1}{2} - \frac{3x - 4}{3} = \frac{3x + 1}{4}$

14. SOLVE: $2x + \frac{3}{2}y = 10$

$\frac{2}{5}x + \frac{1}{3}y = 2$

15. SOLVE: $\frac{5}{2x} = \frac{9 - 2x}{8x} + 3$

16. SOLVE: $1 + \frac{8}{x^2 - 4} = \frac{2}{x - 2}$

UNIT III

Rational Numbers and Expressions

PART II
Test C

DIRECTIONS: Do not write on the test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem. Reduce all answers to lowest terms.

1. FIND THE LCM: $5x^2y,\ 10xy^3$

2. FIND THE LCM: $x^2 - 16;\ x^2 + 6x + 8$

3. ADD: $\frac{5x + 3y}{4} + \frac{6x - 8y}{4}$

4. SUBTRACT: $\frac{6a - 5b}{12} - \frac{a - 3b}{9}$

5. COMBINE: $\frac{3}{ab} + \frac{10}{b^2} - \frac{7}{a^2}$

6. ADD: $\frac{8}{a - 4} + \frac{2}{a + 5}$

7. SUBTRACT: $\frac{a + 9}{a - 6} - \frac{a + 3}{a + 1}$

8. COMBINE: $\frac{x}{x^2 - 9} + \frac{3x}{x + 3} - \frac{5x}{x^2 - 6x + 9}$

9. SIMPLIFY: $\dfrac{\frac{5}{6} - \frac{1}{3}}{\frac{5}{6} - 5}$

10. SIMPLIFY: $\dfrac{\frac{1}{y} - y}{y - y^2}$

11. SIMPLIFY: $\dfrac{1 - \frac{3}{x + 2}}{x + \frac{1}{x - 2}}$

12. SOLVE: $\frac{1}{3}n + \frac{3}{5}n = 14$

13. SOLVE: $\frac{3x+1}{6} - \frac{2x-5}{4} = \frac{4x-1}{2}$

14. SOLVE: $\frac{1}{6}x + \frac{2}{5}y = -2$

$\frac{3}{5}x - y = 5$

15. SOLVE: $\frac{4}{x} - 5 = \frac{5-x}{3x}$

16. SOLVE: $\frac{2}{a^2 - 9} + \frac{1}{a-3} = \frac{7}{3a+9}$

UNIT III

Rational Numbers and Expressions

PART II
Test D

DIRECTIONS: Do not write on the test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. FIND THE LCM: $4c^2d^3, \; 9c^4d$

2. FIND THE LCM: $x^2 - 25, \; x^2 + 4 - 45$

3. ADD: $\dfrac{5ab + 2b^2}{ab} + \dfrac{3ab + a^2}{ab}$

4. SUBTRACT: $\dfrac{2x - y}{3x} - \dfrac{2x - 3y}{2y}$

5. COMBINE: $\dfrac{4}{a^2bc} - \dfrac{5}{ab^2c} + \dfrac{7}{abc^2}$

6. ADD: $\dfrac{6}{x + 4} + \dfrac{4}{x + 8}$

7. SUBTRACT: $\dfrac{5x - y}{3x + y} - \dfrac{6x - 5y}{2x - y}$

8. COMBINE: $\dfrac{6a}{a - b} - \dfrac{3b}{b - a} + \dfrac{5}{a^2 - b^2}$

9. SIMPLIFY: $\dfrac{\frac{2}{5} - \frac{1}{3}}{\frac{2}{5} + \frac{1}{3}}$

10. SIMPLIFY: $\dfrac{1 - \frac{a}{b}}{a - \frac{a}{b^2}}$

11. SIMPLIFY: $\dfrac{y - 2 + \frac{1}{y + 2}}{y + 2 + \frac{1}{y - 2}}$

12. SOLVE: $\frac{1}{4}x - \frac{3}{2} = \frac{1}{6}x$

13. SOLVE: $\frac{3x + 2}{4} - \frac{3x - 4}{4} = \frac{3x + 1}{4}$

14. SOLVE: $\frac{1}{2}x - \frac{1}{9}y = 3$

$\frac{5}{2}x - y = 27$

15. SOLVE: $\frac{5}{2x} = \frac{9 - 2x}{8x} + 3$

16. SOLVE: $\frac{7}{x^2 - 25} - \frac{1}{x + 5} - \frac{4}{3x + 15} = 0$

UNIT III

Rational Numbers and Expressions

PART II
Test A B C D

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UNIT IV Relations and Functions PART I

Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1 through 3, state which of the following sets are functions and which are relations which are not functions? Answer "Function" or "Relation".

1. $A = \{(1, 2), (3, 5), (6, -2), (7, 0)\}$

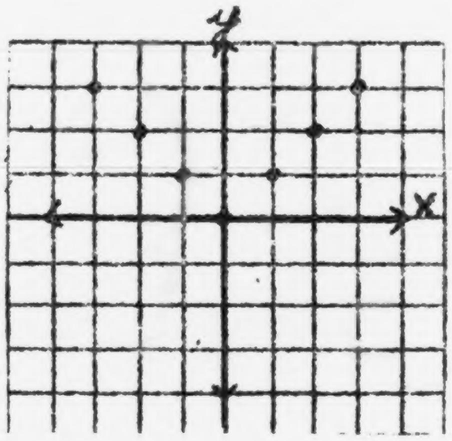
2. $B = \{(1, 0), (2, -2), (7, 0), (8, 3)\}$

3. $C = \{(-1, 5), (-2, 3), (-1, 3), (5, 2)\}$

4. Write the domain of the relation $A = \{(6, 2), (3, 2), (4, 0), (5, -1)\}$.

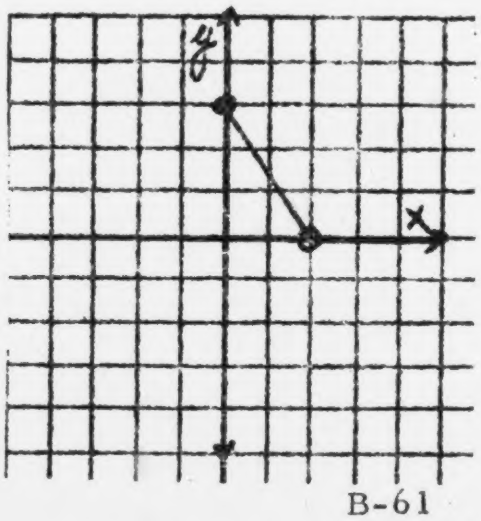
5. Write the range of the relation in Problem 4.

6. Write the domain of the relation defined by the graph below.

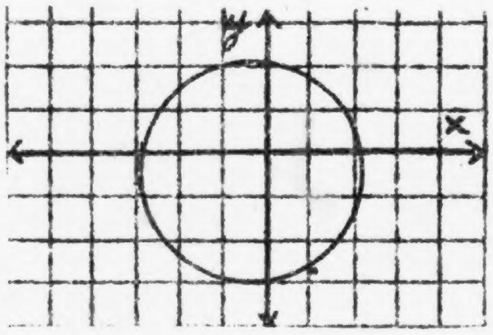


7. Write the range of the relation in Problem 6.

8. Write the domain of the relation defined by the graph below.



9. Is the following graph that of a relation which is not a function? Answer "Function" or "Relation".



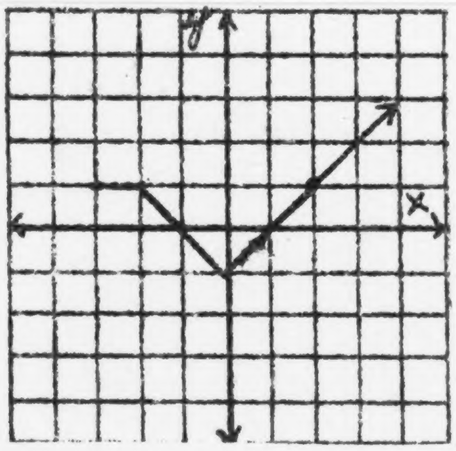
10. What is the domain of the function defined by the open sentence:

$$y = \frac{1}{x^2 - 4}$$

11. Draw the graph of the relation M = $\{(-2, 1), (0, 2), (1, 0), (2, -1)\}$ on the coordinate axes provided on the answer sheet.

12. Draw the graph of the relation f = $\{(x, y) \mid y = 2x - 2, -2 \leq x < 0\}$ .on the coordinate axes provided on the answer sheet.

13. What is the value of the function at 2?



14. If $f(x) = 2x - 1$ defines a function, what is the value of the function at 3. ?

15. COMPLETION: If $g(x) = 5x + 2$, then $g(2) =$ ________________________.

16. COMPLETION: If $f(x) = 2x$ and $g(x) = 3x - 1$, then $f(g(1)) =$ ____________

17. Write an open sentence for y in terms of x which expresses the relation defined in the table below.

x	-1	0	1	2	3
y	-3	0	3	6	9

18. TRUE or FALSE: All lines are graphs of functions.

19. COMPLETION: $\{(x, y) \mid y = 2\}$ is called a (n) ________________ function.

20. TRUE or FALSE: $y = 3x + 1$ is an example of direct variation.

21. COMPLETION: A ratio is the ________________ of two numbers.

22. What is the ratio in lowest terms of 6 inches to 2 feet?

23. Write the extremes of the proportion $5:2 = 10:4$.

24. Solve for a: $\frac{3}{5} = \frac{a+1}{a-1}$

25. Write a formula for the direct variation given in the following statement:

"The perimeter P of a square varies directly as the length of A side s."

UNIT IV **Relations and Functions** PART I
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1 through 3, state which are functions and which are relations that are not functions. Answer "Function" or "Relation".

1. $A = \{(2, 3), (2, 4), (5, 6), (-2, 0)\}$

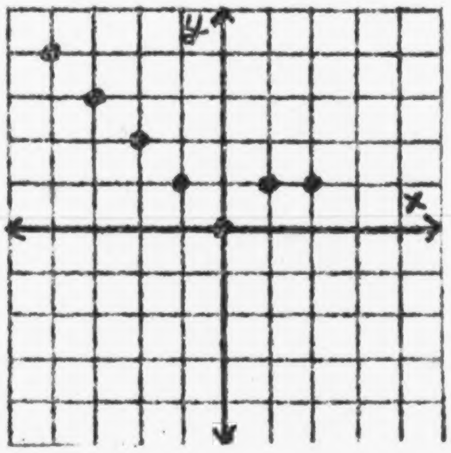
2. $B = \{(3, 0), (-2, 1), (-4, 0), (5, -2)\}$

3. $C = \{(5, -1), (3, 0), (-2, -1), (-2, 5)\}$

4. Write the domain of the relation $A = \{(6, 2), (-3, 1), (0, 8), (5, 1)\}$.

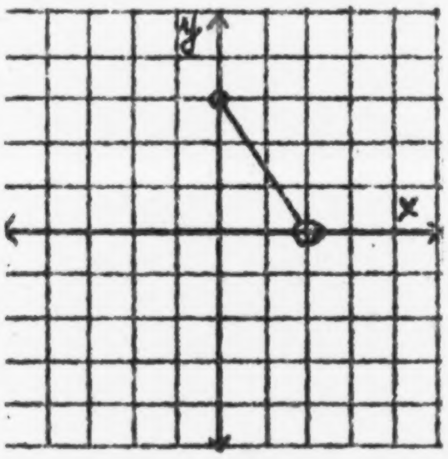
5. Write the range of the relation in Problem 4.

6. Write the domain of the relation defined by the graph.

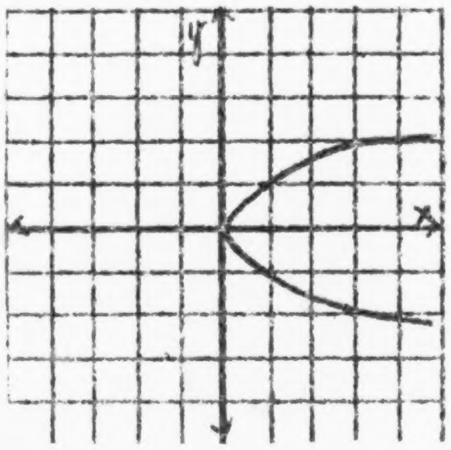


7. Write the range of the relation in Problem 6.

8. Write the range of the relation defined by the graph.



9. Is the following graph that of a function or a relation which is not a function? Answer "Function" or "Relation".



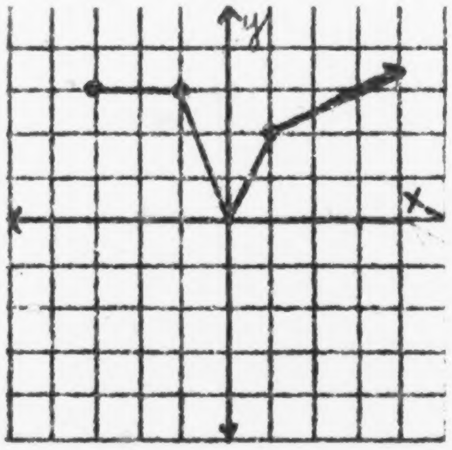
10. What is the domain of the function defined by the open sentence:

$$y = \frac{x}{x^2 - 9}$$

11. Draw the graph of the relation $M = \{(-2, 0), (-1, 0), (0, -1), (1, 3)\}$ on the coordinate axes provided on the answer sheet.

12. Draw the graph of the relation $f = \{(x, y) \mid y = 1 - x,\ 0 \leq x < 1\}$.

13. What is the value of the function below at 1?



14. If $f(x) = 1 - 2x$ defines a function, what is the value of the function at 1?

15. COMPLETION: If $g(x) = 3x - 2$, then $g(1) =$ ________________.

16. COMPLETION: If $f(x) = 3x$ and $g(x) = 2x + 1$, then $f(g(1)) =$ ________________.

17. Write an open sentence for y in terms of x which expresses the relation defined in the table below.

x	-1	0	1	2	3	4
y	-2	0	2	4	6	8

18. TRUE or FALSE: All lines are graphs of functions.

19. COMPLETION: $\{(x, y) \mid y = 3\}$ is an example of a (n) __________ function.

20. TRUE or FALSE: $y = 5x$ is an example of a direct variation.

21. COMPLETION: A proportion is the equality of two __________.

22. What is the ratio in lowest terms of 3 feet to 2 yards?

23. What are the means of the proportion $5:2 = 10:y$?

24. Solve for a: $\frac{3}{5} = \frac{a - 1}{a + 1}$

25. Write a formula for the direct variation given in the following statement:

"The perimeter p of a square varies directly as the length of a side s."

UNIT IV Relations and Functions PART I
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1 through 3, state which of the following sets are functions and which are relations that are not functions? Answer "Function" or "Relation".

1. $R = \{(3,5), (-3,2), (3,2), (-3,5)\}$

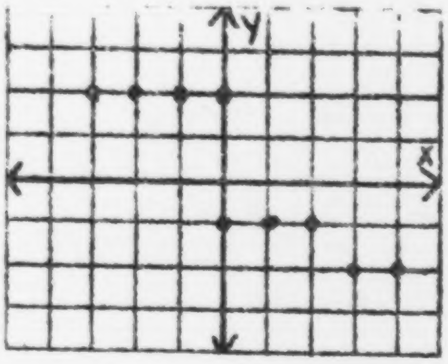
2. $S = \{(2,0), (3,-1), (4,-2), (5,-3)\}$

3. $T = \{(10,1), (8,1), (6,1), (4,1)\}$

4. Write the domain of the relation $B = \{(-3,-1), (-1,1), (1,3), (3,5)\}$.

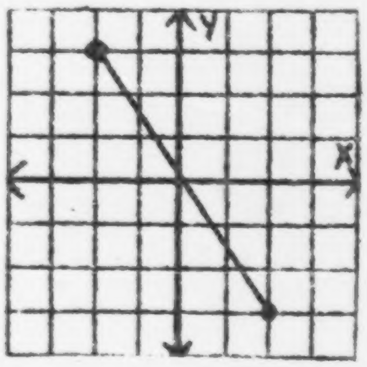
5. Write the range of the relation in Problem 4.

6. Write the domain of the relation defined by the graph below.

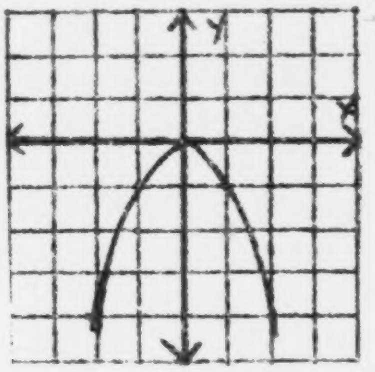


7. Write the range of the relation in Problem 6.

8. Write the range of the relation defined by the graph below.



9. Is the following graph that of a function or that of a relation that is not a function? Answer "Function" or "Relation".



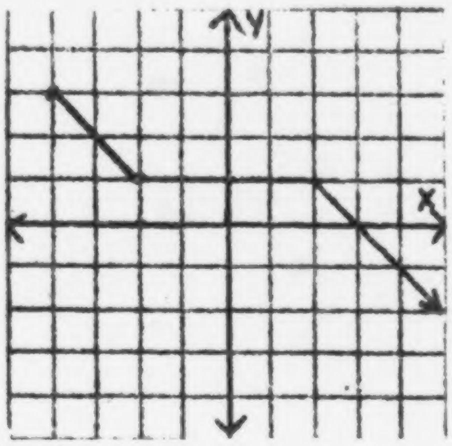
10. What is the domain of the function defined by the open sentence:

$$y = \frac{5}{x^2 - 25}$$

11. Draw the graph of the relation $R = \{(-1, 2), (0, 1), (1, 0), (2, -1)\}$ on the coordinate axes provided on the answer sheet.

12. Draw the graph of the relation $f = \{(x, y) \mid y = 3x + 1, -2 < x \leq 1\}$.

13. What is the value of the function at -3?



14. If $g(x) = 5x + 3$ defines a function, what is the value of the function at -2?

15. COMPLETION: If $f(x) = \frac{1}{2}x - 3$, then $f(4) =$ ________________.

16. COMPLETION: If $f(x) = -3x$ and $g(x) = 2x + 1$, then $f(g(1)) =$ ____________________.

17. Write an open sentence for y in terms of x which expresses the relation defined in the table below.

x	-1	0	1	2	3
y	2	3	4	5	6

18. TRUE or FALSE: All non-vertical lines are graphs of functions.

19. COMPLETION: $\{(x, y) \mid y = -3\}$ is called a (n) ______________.

20. TRUE or FALSE: $y = 2x - 3$ is an example of direct variation.

21. COMPLETION: A ratio is the ______________ of two numbers.

22. What is the ratio in lowest terms of 3 feet to 2 yards?

23. Write the extremes of the proportion $3:2 = 8:5$

24. Solve for x: $\frac{x - 1}{x + 1} = \frac{5}{3}$

25. Write a formula for the direct variation given in the following statement.

"The perimeter P of a square varies directly as the length of a side s."

UNIT IV

Relations and Functions

PART I
Test A B C

NAME ______________________ SECTION __________

TEACHER ______________________ DATE __________

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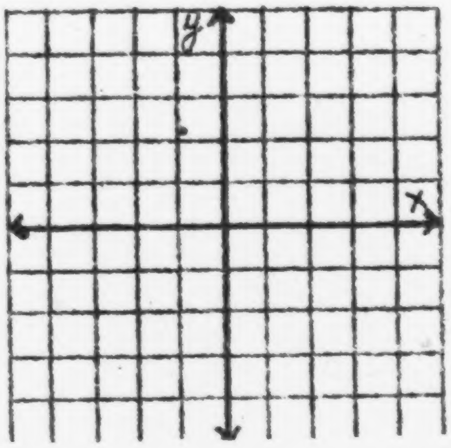
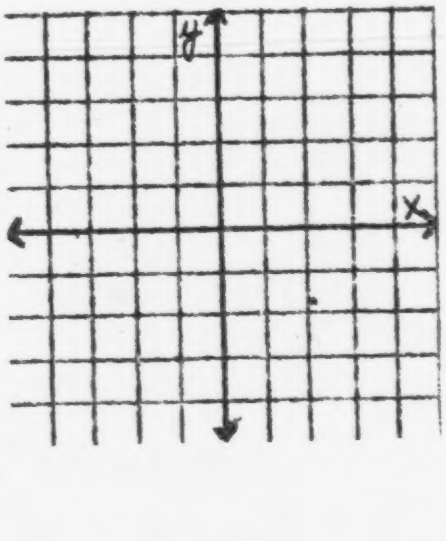
11.



12.



13. ______________________
14. ______________________
15. ______________________
16. ______________________
17. ______________________
18. ______________________
19. ______________________
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25. ______________________

UNIT IV

Relations and Functions

PART II
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. COMPLETION: $|-8| =$ _____

2. Find the solution set of $|x| = 7$

3. Find the solution set of $|x - 2| = 1$

4. Draw the graph of the solution set of $|2x - 1| \leq 3$

5. Find the solution set of $|x| = -1$

6. Draw the graph of the function defined by the open sentence $y = |x|$ on the coordinate axes provided.

7. Draw the graph of the function defined by $y = \begin{cases} 2x, & \text{if } x < 0 \\ 3x + 1, & \text{if } x \geq 0 \end{cases}$ on the coordinate axes provided.

8. Which of the following are quadratic functions?

   I. $y = 3x + 2$
   III. $y = x^2 + 3$
   II. $y = 4x^2$
   IV. $y = 3x^2 - 2x + 6$

   A: Only I.
   B. Only II, III, IV.
   C. All are quadratic functions.
   D. Only II and III.

9. COMPLETION: The graph of $y = 3x^2$ is called a (n) __________.

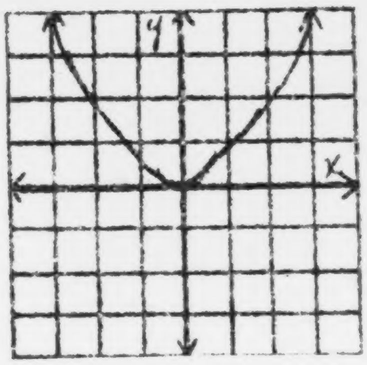
10. The graph of $y = -2x^2$ is concave __________________ (upwards, downwards).

11. TRUE or FALSE: The x-axis is the axis of symmetry of the curve whose equation is $y = 2x^2$.

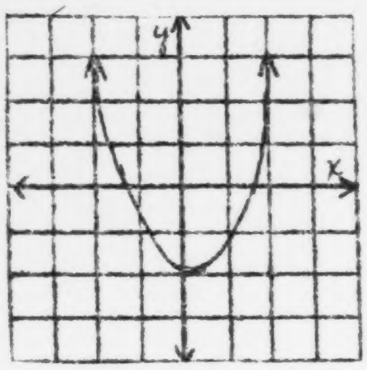
12. Write the equation of the axis of symmetry of the curve whose equation is $y = 3(x - 2)^2$.

13. MULTIPLE CHOICE: Which of the following could be the graph of the equation $y = x^2 + 2$?

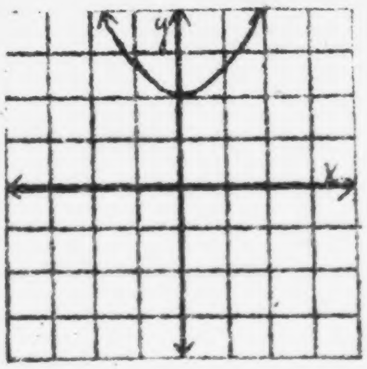
A.



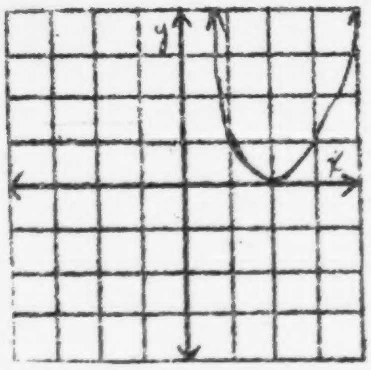
B.



C.



D.



Answer each of Problems 14 through 16 with reference to the curve whose equation is $y = -2(x + 1)^2 - 3$.

14. Write the vertex of the curve.

15. Write the equation of the axis of symmetry.

16. COMPLETION: The curve is concave ______________________ (upwards, downwards).

17. With what number should k be replaced to make $x^2 + 8x + k$ a trinomial which is the square of a binomial?

Answer each of Problems 18 through 20 with reference to the curve whose equation is $y = 2x^2 - 4x + 1$.

18. Write the equation of the axis of symmetry.

19. Write the coordinates of the vertex.

20. Draw the graph of the curve on the axes provided.

UNIT IV

Relations and Functions

PART II
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. COMPLETION: $|-16| =$ ______

2. Find the solution set of $|x| = 3$.

3. Find the solution set of $|x - 1| = 2$.

4. Draw the graph of the solution set of $|3x - 2| \leq 1$.

5. Find the solution set of $|x| = 0$.

6. Draw the graph of the function defined by the open sentence $y = |x|$ on the coordinate axes provided.

7. Draw the graph of the function defined by $y = \begin{cases} x, & \text{if } x < 0 \\ 2x + 1, & \text{if } x \geq 0 \end{cases}$ on the coordinate axes provided.

8. Which of the following are quadratic functions?

   I. $y = 2x^2$ III. $y = x^2 + 6$

   II. $y = 3 + x$ IV. $y = 2x^2 + x - 3$

   A. Only II.
   B. Only I, III, IV.
   C. Only IV.
   D. Only I and III.

9. COMPLETION: The graph of $y = x^2$ is called a(n) ______________.

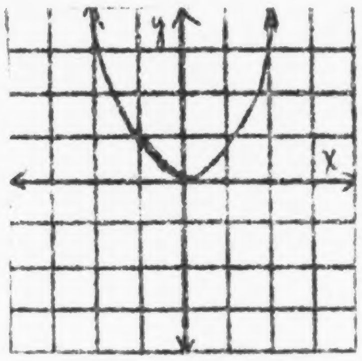
10. COMPLETION: The graph of $y = 2x^2$ is concave________________ (upwards, downwards).

11. TRUE or FALSE: The y-axis is the axis of symmetry of the curve whose equation is $y = 2x^2$.

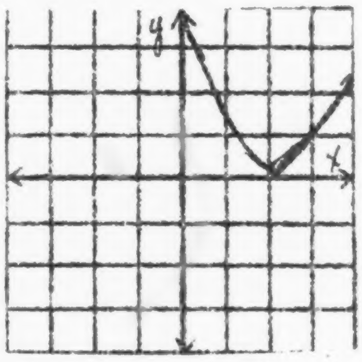
12. Write the equation of the axis of symmetry of the curve whose equation is $y = 2(x - 1)^2$.

13. MULTIPLE CHOICE: Which of the following could be the graph of $y = (x - 2)^2$.

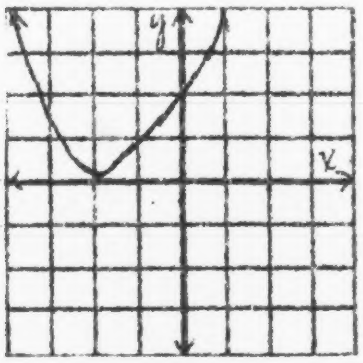
A.



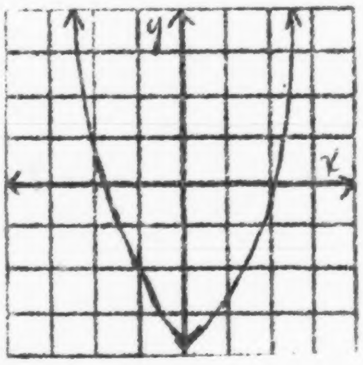
B.



C.



D.



Answer each of Problems 14 through 16 with reference to the curve whose equation is $y = 2(x - 3)^2 + 1$.

14. Write the vertex of the curve.

15. Write the equation of the axis of symmetry.

16. COMPLETION: The curve is concave ____________________ (upwards, downwards).

17. With what number should k be replaced to make $x^2 - 4x + k$ a trinomial which is the square of a binomial?

Answer each of Problems 18 through 20 with reference to the curve whose equation is $y = x^2 + 2x + 2$.

18. Write the equation of the axis of symmetry.

19. Write the coordinates of the vertex.

20. Draw the graph of the curve on the axes provided.

UNIT IV

Relations and Functions

PART II
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. COMPLETION: $|-10| =$ ______

2. Find the solution set of $|x| = 6$.

3. Find the solution set of $|x - 1| = 5$.

4. Draw the graph of the solution set of $|2x - 1| \leq 5$.

5. Find the solution set of $|x| = -2$.

6. Draw the graph of the function defined by the open sentence $y = |x|$ on the coordinate axes provided.

7. Draw the graph of the function defined by $y = \begin{cases} 2x, & \text{if } x < 0 \\ 2x + 1, & \text{if } x \geq 0 \end{cases}$ on the coordinate axes provided.

8. Which of the following are quadratic functions?

   I. $y = 2x^2$
   III. $y = x^2 + 6$
   II. $y = x + 3$
   IV. $y = 2x^2 + x - 3$

   A. Only II.
   B. Only I and III.
   C. Only IV.
   D. Only I, III, IV.

9. COMPLETION: The graph of $y = -2x^2$ is called a(n)____________.

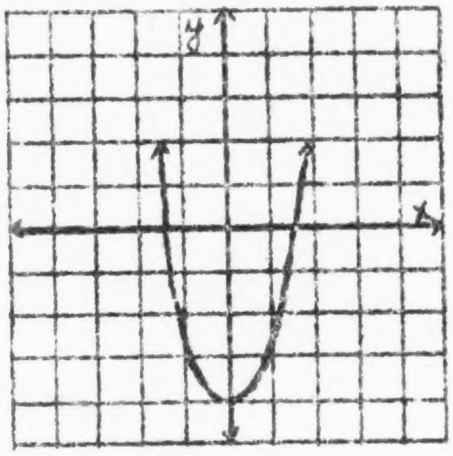
10. COMPLETION: The graph of $y = -2x^2$ is concave______________ (upward, downward).

11. TRUE or FALSE: The y-axis is the axis of symmetry of the curve whose equation is $y = -2x^2$.

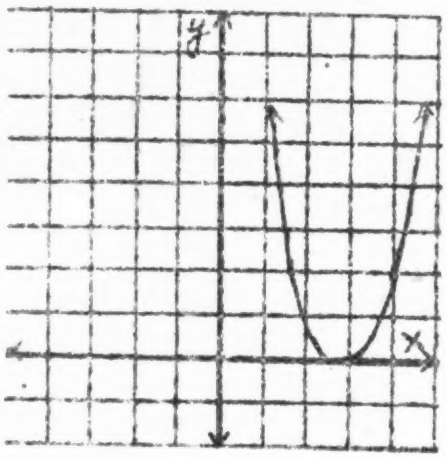
12. Write the equation of the axis of symmetry of the curve whose equation is $y = (x - 2)^2$.

13. MULTIPLE CHOICE: Which of the following could be the graph of $y = x^2 + 5$?

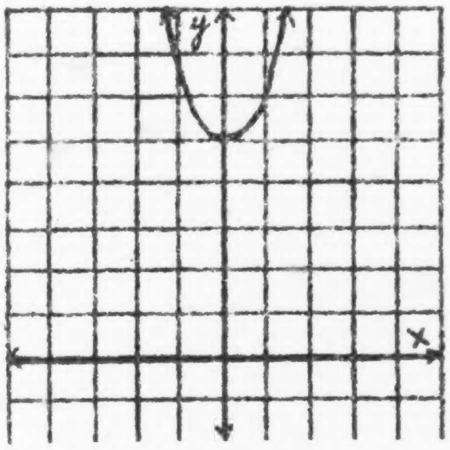
A.



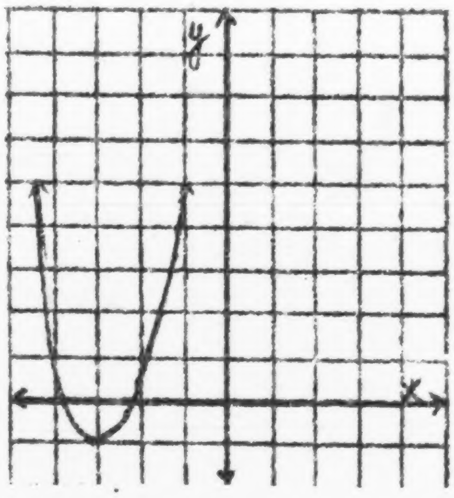
B.



C.



D.



Answer each of the Problems 14 through 16 with reference to the curve whose equation is $y = 2(x + 1)^2 - 3$.

14. Write the vertex of the curve.

15. Write the equation of the axis of symmetry.

16. COMPLETION: The curve is concave ____________________ (upward, downward).

17. With what number should k be replaced to make $x^2 - 4x + k$ a trinomial which is the square of a binomial?

Answer each of the Problems 18 through 20 with reference to the curve whose equation is $y = 5 - 2x - x^2$.

18. Write the equation of the axis of symmetry.

19. Write the coordinates of the vertex.

20. Draw the graph of the curve on the axes provided.

UNIT IV

Relations and Functions

PART II
Test A B C

NAME SECTION

TEACHER DATE

SCORE PERIOD

1.

2.

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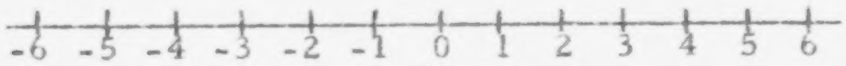
-6
-5
-4
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-2
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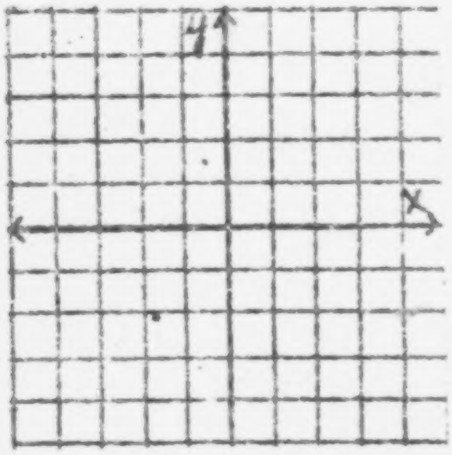
6

5.

6.



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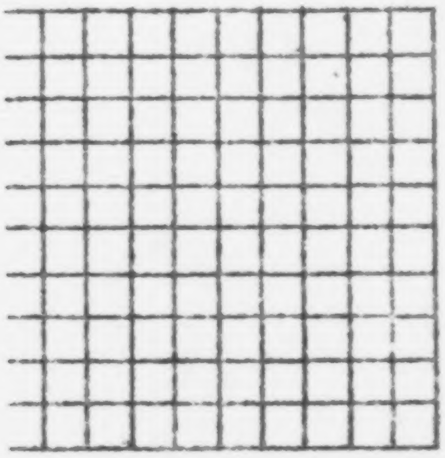

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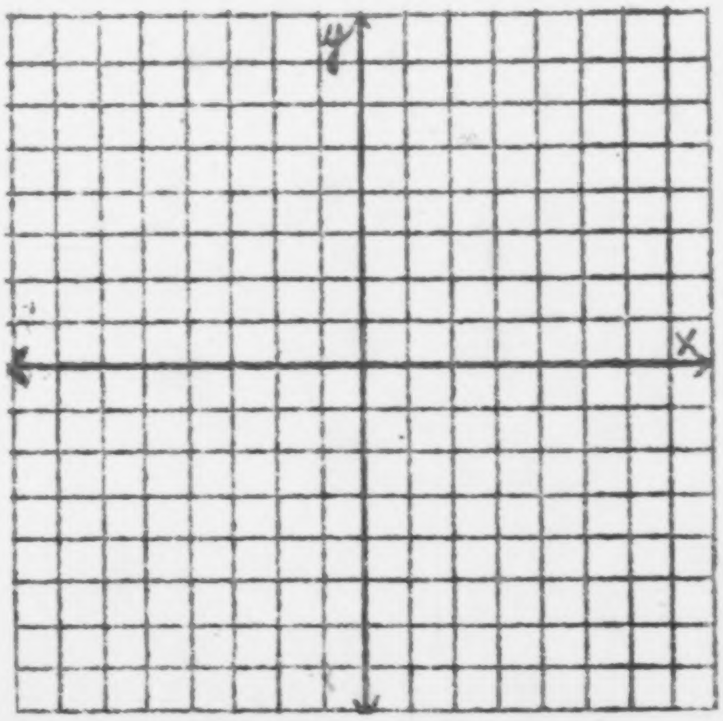

UNIT V

Real Numbers

PART I
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. If the graph of $y = x^n$ is symmetric with respect to the y-axis, then n is:

   A. an odd integer
   B. a prime number
   C. an even integer
   D. a composite number
   E. None of these.

2. If n is an odd integer, then the graph of $y = x^n$ is symmetric with respect to the:

   A. x-axis
   B. y-axis
   C. line $y = x$
   D. origin
   E. None of these.

3. The graph of the equation $y = x^n$ where n is a positive even integer has:

   A. A maximum point at (0, 0).
   B. A minimum point at (0, 0).
   C. No maximum or minimum point.
   D. A maximum point and a minimum point.
   E. None of these.

4. If the square root of b is x, then:

   A. $x = 2b$
   B. $b = 2x$
   C. $b^2 = x$
   D. $x^2 = b$
   E. None of these.

5. TRUE or FALSE: If n is even and b is negative, there is no real n^{th} root of b.

6. TRUE or FALSE: If n is odd and b is negative, there is no real n^{th} root of b.

7. TRUE or FALSE: If n is odd and b is positive, there is one positive n^{th} root of b and one negative n^{th} root of b.

In Problems 8 - 13, simplify:

8. $\sqrt{16}$

9. $\sqrt[3]{125}$

10. $\sqrt[3]{-\frac{1}{8}}$

11. $\sqrt[7]{128}$

12. $\sqrt[100]{0}$

13. $\sqrt{.25}$

14. Which of the following are real numbers?

A. $\sqrt{-1}$

C. $\sqrt[3]{-5}$

B. $\sqrt{7}$

D. $\sqrt[10]{-10}$

15. If the $\sqrt[n]{-8}$ is a real number, then n is:

A. an even integer

B. an odd integer

C. any integer

D. not able to be determined from the information given

In Problems 16-19 simplify the given radical expression.

16. $\sqrt[4]{2^4}$

17. $\sqrt[3]{(-3)^3}$

18. $\sqrt{(-5)^2}$

19. $(\sqrt[4]{10})^4$

In Problems 20 and 21 give the solution set of the given equation.

20. $3x^2 = 27$

21. $4x^3 + 16 = 0$

22. TRUE or FALSE: The rational numbers are closed under addition.

23. TRUE or FALSE: The rational numbers are not closed under multiplication.

24. TRUE or FALSE: If a and b are unequal rational numbers, then $\frac{a+b}{2}$ is a rational number between them.

25. Which of the following numbers is irrational?

A. 2
B. 0
C. $\frac{4}{7}$
D. $\sqrt{7}$
E. $.54$

26. Which of the following rational numbers is definitely not a root of $3x^8 - 4x^2 + 5x + 2 = 0$. (Apply the theorem on rational roots.)

A. 2
B. -2
C. $\frac{1}{3}$
D. $-\frac{2}{3}$
E. $\frac{1}{2}$

27. TRUE or FALSE: The set of irrational numbers is closed under multiplication.

28. TRUE or FALSE: The sum of a rational number and an irrational number is always an irrational number.

UNIT V

Real Numbers

PART I
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. If the graph of $y = x^n$ is symmetric with respect to the y-axis, then n is:

A. a prime number
B. an even integer
C. a composite number
D. an odd integer
E. none of these

2. If n is an odd integer, then the graph of $y = x^n$ is symmetric with respect to the:

A. origin
B. x-axis
C. y-axis
D. line $y = x$
E. none of these

3. The graph of the equation $y = x^n$ where n is a positive even integer has:

A. a maximum point and a minimum point
B. no maximum point or minimum point
C. a minimum point at (0, 0)
D. a maximum point at (0, 0)
E. none of these

4. If the square root of a is x, then:

A. $a = 2x$
B. $x = 2a$
C. $a^2 = x$
D. $x^2 = a$
E. none of these

5. TRUE or FALSE: If n is odd and b is negative, there is no real n^{th} root of b.

6. TRUE or FALSE: If n is odd and b is positive, there is one positive n^{th} root of b and one negative n^{th} root of b.

7. TRUE or FALSE: If n is even and b is negative, there is no real n^{th} root of b.

In Problems 8-13, simplify.

8. $\sqrt{49}$

9. $\sqrt[3]{64}$

10. $\sqrt[3]{\frac{-1}{27}}$

11. $\sqrt[112]{0}$

12. $\sqrt[6]{64}$

13. $\sqrt{.36}$

14. Which of the following are not real numbers?

A. $\sqrt{-1}$

B. $\sqrt{7}$

C. $\sqrt[3]{-5}$

D. $\sqrt[10]{-6}$

15. If the $\sqrt[n]{-8}$ is not a real number, then n is:

A. an even number

B. an odd integer

C. any integer

D. not able to be determined from the information given

In Problems 16-19, simplify the given radical expression.

16. $\sqrt[5]{6^5}$

17. $\sqrt[3]{(-2)^3}$

18. $\sqrt{(-3)^2}$

19. $(\sqrt[5]{11})^5$

In Problems 20 and 21 give the solution set of the given equation.

20. $3x^5 - 36 = 0$

21. $4x^2 = 36$

22. TRUE or FALSE: The rational numbers are not closed under addition.

23. TRUE or FALSE: The rational numbers are closed under multiplication.

24. TRUE or FALSE: If a and b are unequal rational numbers, then $\frac{a+b}{2}$ is a rational number between them.

25. Which of the following numbers is irrational?

A. 3

B. $\frac{1}{6}$

C. $\sqrt{5}$

D. $\sqrt[3]{8}$

E. .75

26. Which of the following rational numbers is definitely not a root of $3x^7 - 4x^2 + 5x + 2 = 0$? (Apply the theorem on rational roots.)

A. -2

B. 2

C. $-\frac{2}{3}$

D. $\frac{1}{2}$

E. $\frac{1}{3}$

27. TRUE or FALSE: The set of irrational numbers is closed under multiplication.

28. TRUE or FALSE: The sum of a rational number and an irrational number is always a rational number.

UNIT V

Real Numbers

PART I
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. If the graph of $y = x^n$ is symmetric with respect to the origin then n is:

   A. an odd integer
   B. a prime number
   C. an even integer
   D. a composite number
   E. none of these

2. If n is an even integer then the graph of $y = x^n$ is symmetric with respect to the:

   A. x-axis
   B. y-axis
   C. line $y = x$
   D. origin
   E. none of these

3. The graph of the function $y = x^n$ where n is a positive odd integer has:

   A. a maximum point at (0, 0)
   B. a minimum point at (0, 0)
   C. no maximum or minimum point
   D. a maximum point and a minimum point.
   E. none of these

4. If the square root of b is x then:

   A. $x = 2b$
   B. $b = 2x$
   C. $x^2 = b$
   D. $x^2 = b$
   E. none of these

5. TRUE or FALSE: If n is odd and b is negative, there is no real n^{th} root of b.

6. TRUE or FALSE: If n is odd and b is positive, there is one positive n^{th} root of b.

7. TRUE or FALSE: If n is even and b is positive, there is one positive n^{th} root of b and one negative n^{th} root of b.

In Problems 8-13, simplify.

8. $\sqrt{9}$

9. $\sqrt[3]{-8}$

10. $\sqrt[4]{\frac{1}{16}}$

11. $\sqrt[5]{-1}$

12. $\sqrt{.0049}$

13. $\sqrt[3]{\frac{1}{27}}$

14. Which of the following are real numbers?

A. $\sqrt{-4}$

B. $\sqrt[4]{3}$

C. $\sqrt[3]{-9}$

D. $\sqrt[4]{-81}$

15. If the $\sqrt[n]{-8}$ is a real number, then n is:

A. an even integer

B. an odd integer

C. any integer

D. not able to be determined from the information given

In Problems 16-19 simplify the given radical expression.

16. $\sqrt[4]{(-2)^4}$

17. $\sqrt[3]{(-3)^3}$

18. $\sqrt{(1000)^2}$

19. $(\sqrt[5]{17})^5$

In Problems 20 and 21 give the solution set of the given equation.

20. $5x^2 = 125$

21. $3x^3 - 9 = 0$

22. TRUE or FALSE: The rational numbers are closed under addition.

23. TRUE or FALSE: The rational numbers are closed under multiplication.

24. TRUE or FALSE: If a and b are unequal rational numbers, then $\frac{a + b}{2}$ is a rational number between them.

25. Which of the following numbers are irrational?

A. .33

B. .333...

C. $\frac{1}{3}$

D. $\sqrt{3}$

E. none of these

26. Which of the following rational numbers is definitely not a root of $3x^8 - 4x^2 + 5x + 2 = 0$? (Apply the theorem on rational roots.)

A. 2

B. -2

C. $\frac{1}{3}$

D. $-\frac{2}{3}$

E. $\frac{1}{2}$

27. TRUE or FALSE: The set of irrational numbers is closed under addition.

28. TRUE or FALSE: The sum of a rational number and an irrational number is never a rational number.

UNIT V

Real Numbers

PART I
Test A B C

NAME________________________________ SECTION__________

TEACHER______________________________ DATE____________

SCORE________________________________ PERIOD__________

1. ____________________
2. ____________________
3. ____________________
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20. ____________________
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23. ____________________
24. ____________________
25. ____________________
26. ____________________
27. ____________________
28. ____________________

UNIT V

Real Numbers

PART II
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Express $.\overline{37}$ as the quotient of two integers.

2. Using the average method, determine a rational number between $\frac{1}{7}$ and $\frac{1}{6}$.

3. Between any two real numbers, there is another real number. This is a statement of the:

   A. Product Property of Radicals

   B. Property of Density

   C. Axiom of Completeness

   D. Trichotomy Principle

4. TRUE or FALSE: Every rational number can be written as a finite decimal.

5. TRUE or FALSE: Every finite decimal or infinite periodic decimal names a rational number.

6. COMPLETION: ________________ numbers are numbers that are not rational.

7. Which of the following decimals represents an irrational number?

   A. .353553555...

   B. .35

   C. .353535...

   D. None of these.

8. TRUE or FALSE: The sum of two irrational numbers may be either rational or irrational.

9. TRUE or FALSE: The product of an irrational number and a non-zero rational number is never irrational.

In Problems 10-12, write the expression in radical form.

10. $5^{\frac{1}{2}}$

11. $a^{\frac{1}{r}}$ where r is a positive integer and $a \geq 0$

12. $a^{\frac{3}{5}}$ where $a \geq 0$

In Problems 13-15 write the expression in exponential form with all positive exponents. Assume all variables are positive.

13. $\sqrt[3]{3}$

14. $\sqrt{9a^{-1} b^{8}}$

15. $\sqrt[3]{84a^{5} b^{6}}$

In Problems 16-32 write the expression in simplest radical form.

16. $8^{\frac{2}{3}}$

17. $(125)^{-\frac{4}{3}}$

18. $\sqrt[10]{25}$

19. $\sqrt[3]{\sqrt{27}}$

20. $\sqrt{2^{5}} \cdot \sqrt[4]{2}$

21. $\sqrt[6]{32} \div \sqrt[3]{2}$

22. $\sqrt{12}$

23. $\sqrt[3]{32x^{3} y^{4}}$

24. $\sqrt{24x}$

25. $\dfrac{6}{\sqrt{2}}$

26. $\frac{\sqrt{7}}{\sqrt{2}}$

27. $\sqrt{\frac{3y^{-1}}{9}}$

28. $\sqrt[3]{\frac{1}{54 x 5}}$

29. $2 \sqrt[5]{-64}$

30. $\sqrt[6]{x^{-7} y^{11}}$

31. $\frac{6 \sqrt{48x^5}}{2 \sqrt{3x}}$

32. $\sqrt{a^2 - 10a + 25}$

33. SOLVE: $b^{\frac{1}{5}} = 2$

UNIT V

Real Numbers

PART II
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Express $.\overline{23}$ as a quotient of two integers.

2. Using the average method determine a rational number between $\frac{1}{9}$ and $\frac{1}{8}$.

3. Between any two real numbers, there is another real number. This is a statement of the:

   A. Axiom of Completeness
   B. Property of Radicals
   C. Trichotomy Principle
   D. Property of Density

4. TRUE or FALSE: Every rational number can be written as a finite decimal or an infinite periodic decimal.

5. TRUE or FALSE: Every finite decimal or infinite periodic decimal names a rational number.

6. COMPLETION: ________________ numbers are numbers that are not rational.

7. Which of the following decimals represent an irrational number?

   A. .46
   B. .464664666...
   C. .464646...
   D. None of these.

8. TRUE or FALSE: The sum of two irrational numbers is always an irrational number.

9. TRUE or FALSE: The product of two irrational numbers may be a rational number or an irrational number.

In Problems 10-12 write the expression in radical form.

10. $7^{\frac{1}{2}}$

11. $b^{\frac{1}{r}}$ where r is a positive integer and $b \geq 0$.

12. $b^{\frac{4}{4}}$

In Problems 13-15 write the expressions in exponential form with all positive exponents. Assume all variables are positive.

13. $\sqrt{5}$

14. $\sqrt{16x^{-1}y^{8}}$

15. $\sqrt[3]{54x^{5}b^{6}}$

In Problems 16-32 write the expression in simplest radical form.

16. $64^{\frac{2}{3}}$

17. $27^{-\frac{4}{3}}$

18. $\sqrt[12]{25}$

19. $\sqrt{\sqrt[3]{36}}$

20. $\sqrt[4]{2} \cdot \sqrt[4]{2^{5}}$

21. $\sqrt[6]{32} \div \sqrt[3]{2}$

22. $\sqrt{18}$

23. $\sqrt[3]{40x^{3}y^{5}}$

24. $\sqrt{20x}$

25. $\dfrac{6}{\sqrt{3}}$

26. $\frac{\sqrt{10}}{\sqrt{3}}$

27. $\sqrt{\frac{12x^{-1}}{25}}$

28. $\sqrt[3]{\frac{1}{16r^5}}$

29. $4\sqrt[5]{-64}$

30. $\sqrt[5]{x^8 y^{-7}}$

31. $\frac{8\sqrt{54x^5}}{4\sqrt{3x}}$

32. $\sqrt{x^2 - 6x + 9}$

33. SOLVE: $b^{\frac{2}{3}} = 8$

UNIT V

Real Numbers

PART II
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Express $.\overline{46}$ as a quotient of two integers.

2. Using the average method, determine a rational number between $\frac{1}{6}$ and $\frac{1}{5}$.

3. Between any two real numbers, there is another real number. This is a statement of the:

   A. Trichotomy Principle

   B. Axiom of Completeness

   C. Property of Density

   D. Property of Radicals

4. TRUE or FALSE: Every rational number can be written as a finite decimal or an infinite periodic decimal.

5. TRUE or FALSE: Not every finite decimal or infinite periodic decimal names a rational number.

6. COMPLETION: ________________ numbers are numbers that are not rational.

7. Which of the following decimals represents an irrational number?

   A. .10
   C. .101101110....
   B. .101010...
   D. None of these.

8. TRUE or FALSE: The sum of two irrational numbers is always an irrational number.

9. TRUE or FALSE: The product of two irrational numbers may be a rational number or an irrational number.

In Problems 10-12 write the expressions in radical form.

10. $6^{\frac{1}{4}}$

11. $c^{\frac{1}{r}}$ where r is a positive integer and $c \geq 0$.

12. $c^{\frac{2}{3}}$ where $c \geq 0$.

In Problems 13-15 write the expressions in exponential form with all positive exponents. Assume all variables are positive.

13. $\sqrt[4]{9}$

14. $\sqrt{25x^{-3}y^{10}}$

15. $\sqrt[3]{16x^7y^5}$

In Problems 16-32 write the expressions in simplest radical form.

16. $8^{\frac{2}{3}}$

17. $27^{-\frac{4}{3}}$

18. $\sqrt[10]{25}$

19. $\sqrt{\sqrt[3]{36}}$

20. $\sqrt[4]{2^5} \cdot \sqrt[4]{2}$

21. $\sqrt[6]{32} \div \sqrt[3]{2}$

22. $\sqrt{12}$

23. $\sqrt[3]{40x^3y^5}$

24. $\sqrt{24x}$

25. $\frac{6}{\sqrt{3}}$

26. $\frac{\sqrt{7}}{\sqrt{2}}$

27. $\sqrt{\frac{12x^{-1}}{25}}$

28. $\sqrt[3]{\frac{1}{54x^5}}$

29. $4\sqrt[5]{-64}$

30. $\sqrt[6]{x^{-7}y^{11}}$

31. $\frac{8\sqrt{54x^5}}{4\sqrt{3x}}$

32. $\sqrt{a^2 - 10a + 25}$

33. $b^{\frac{1}{3}} = 4$

UNIT V

Real Numbers

PART II
Test A B C

NAME____________________ SECTION________

TEACHER____________________ DATE________

SCORE____________________ PERIOD________

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31. ________________
32. ________________
33. ________________

UNIT V Real Numbers PART III

Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Which of the following radical expressions are similar?

A. $\sqrt{2}$ and $\sqrt[3]{2}$

B. $\sqrt[5]{5}$ and $\sqrt[5]{10}$

C. $\sqrt[3]{7}$ and $\sqrt[6]{7}$

D. $\sqrt[4]{3}$ and $\sqrt[4]{9}$

E. $\sqrt[3]{3}$ and $3\sqrt[3]{3}$

In Problems 2-4, simplify.

2. $\sqrt{12} + 4\sqrt{3}$

3. $\frac{1}{3}\sqrt{54} - 2\sqrt{96} + 3\sqrt{24}$

4. $\sqrt{18y^4} - 3\sqrt{8y^4} + 2\sqrt{50y^4}$

5. MULTIPLY: $4\sqrt{3}(2\sqrt{3} - 5)$

6. MULTIPLY: $(2\sqrt{11} - 3)(3\sqrt{11} + 5)$

7. Name the conjugate of $5\sqrt{3} - \sqrt{7}$

8. SIMPLIFY: $\dfrac{6}{2\sqrt{7} - 3}$

9. SIMPLIFY: $\dfrac{\sqrt{5}}{\sqrt{5} + \sqrt{2}}$

10. Which of the following is a quadratic equation?

A. $x^3 - x^2 = 0$

B. $5x^2 - 2x + 1 = 0$

C. $4x - 2 = 7$

D. $x^{10} - 7x^5 + x^2 - 3 = 0$

E. None of these.

11. To complete the square of $x^2 - 6x$ you would have to add:

A. 3 C. 9

B. -3 D. -9

12. To complete the square $x^2 + x$, you would have to add.

A. $\frac{1}{4}$ C. 1

B. $-\frac{1}{4}$ D. -1

13. Write $4x^2 = -3 + 5x$ in standard form such that the coefficient of x^2 is positive.

14. If $ax^2 + bx + c = 0$, then x equals:

A. $\frac{b \pm \sqrt{b^2 - 4ac}}{2a}$ C. $\frac{-b}{2a} \pm \sqrt{b^2 - 4ac}$

B. $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ D. None of these.

15. SOLVE: $x^2 + 7x + 6 = 0$

16. SOLVE: $8y^2 - 2y - 1 = 0$

17. SOLVE: $5x^2 - 7x = -2$

18. Without solving the equation, tell the sum of the roots of $3x^2 - 5x + 1 = 0$.

19. Without solving the equation, tell the product of the roots of $4x^2 - 6x - 5 = 0$.

20. Write in standard form a quadratic equation whose roots are 5 and -2.

21. SOLVE: $\sqrt[3]{x + 1} = 3$

22. SOLVE: $\sqrt{5x + 1} = 4$

23. SOLVE: $\sqrt{y - 2} = 4 - y$

UNIT V

Real Numbers

PART III
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Which of the following radical expressions are similar?

   A. $\sqrt{6}$ and $\sqrt{5}$

   B. $3\sqrt{5}$ and $\sqrt{5}$

   C. $\sqrt[3]{6}$ and $\sqrt{6}$

   D. $\sqrt[4]{5}$ and $\sqrt[3]{5}$

In Problems 2-4, simplify.

2. $5\sqrt{6} + 3\sqrt{6} - 4\sqrt{6}$

3. $\sqrt{27} - 2\sqrt{3} + \sqrt{18}$

4. $x\sqrt{4x} + \sqrt{81x^3} - 25\sqrt{25x^3}$, $x \geq 0$

5. MULTIPLY: $3\sqrt{5}(\sqrt{7} - 2)$

6. MULTIPLY: $(\sqrt{3} + \sqrt{5})^2$

7. Name the conjugate of $\sqrt{6} + 2$.

8. SIMPLIFY: $\dfrac{3}{\sqrt{5} + 2}$

9. SIMPLIFY: $\dfrac{3}{\sqrt{7} - \sqrt{5}}$

10. Which of the following is a quadratic equation?

    A. $9x^2 - 4x + 3 = 0$

    B. $x^4 + 3x^3 = 0$

    C. $3x + 7 = 9$

    D. $3x^3 - 2x^2 + 1 = 3$

    E. None of these.

11. To complete the square of $x^2 + 10x$, you would have to add:

A. 5 C. 25

B. -5 D. -25

12. To complete the square of $x^2 - x$, you would have to add:

A. 1 C. $\frac{1}{4}$

B. -1 D. $\frac{1}{2}$

13. Write $3x^2 = 7x + 4$ in standard form, such that the coefficient of x^2 is positive.

14. If $ax^2 + bx + c = 0$, then x equals:

A. $\frac{b \pm \sqrt{b^2 - 4ac}}{2a}$ C. $\frac{-a \pm \sqrt{b^2 - 4ac}}{2b}$

B. $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ D. None of these.

15. SOLVE: $x^2 + 4x + 3 = 0$

16. SOLVE: $2x^2 - 3x - 4 = 0$

17. SOLVE: $5x^2 + 7x = -2$

18. Without solving the equation, tell the sum of the roots of $4x^2 - 7x + 1 = 0$.

19. Without solving the equation, tell the product of the roots of $3x^2 - 6x - 5 = 0$.

20. Write in standard form a quadratic equation whose roots are 7 and -3.

21. SOLVE: $\sqrt[4]{y - 1} = 3$

22. SOLVE: $\sqrt{5x - 1} = 3$

23. SOLVE: $\sqrt{x - 5} = x - 7$

Real Numbers

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Which of the following radical expressions are similar?

A. $\sqrt{5}$ and $\sqrt{3}$

B. $\sqrt[4]{9}$ and $\sqrt[4]{6}$

C. $\sqrt[3]{5}$ and $3\sqrt[3]{5}$

D. $\sqrt[4]{9}$ and $\sqrt[5]{9}$

E. $\sqrt[3]{7}$ and $3\sqrt[6]{7}$

In Problems 2-4, simplify.

2. $5\sqrt{6} + 9\sqrt{6} - 20\sqrt{6}$

3. $\frac{1}{2}\sqrt{8} + 2\sqrt{32} - \sqrt{128}$

4. $\sqrt{18y^4} - 3\sqrt{8y^4} + 2\sqrt{50y^4}$

5. MULTIPLY: $6\sqrt{2}\,(2\sqrt{3} - 5)$

6. MULTIPLY: $(\sqrt{3} + \sqrt{10})^2$

7. Name the conjugate of $\sqrt{5} - 3\sqrt{7}$

8. SIMPLIFY: $\dfrac{5}{\sqrt{3} + 7}$

9. SIMPLIFY: $\dfrac{\sqrt{2}}{\sqrt{7} - \sqrt{5}}$

10. Which of the following is a quadratic equation?

A. $x^4 + 3x^3 = 0$

B. $3x^3 - 2x^2 + 4 = 0$

C. $x^2 + x + 1 = 0$

D. $3x - 2 = 0$

E. None of these.

11. To complete the square of $x^2 - 5x$ you would have to add:

A. $\frac{5}{2}$ C. $\frac{25}{4}$

B. $-\frac{5}{2}$ D. $-\frac{25}{4}$

12. To complete the square of $x^2 - x$ you would have to add:

A. 1 C. $\frac{1}{2}$

B. -1 D. $\frac{1}{4}$

13. Write $9x^2 = -14 + 3x$ in standard form such that the coefficient of x^2 is positive.

14. If $ax^2 + bx + c = 0$, then x equals:

A. $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ C. $b \pm \sqrt{\frac{b^2 - 4ac}{2a}}$

B. $\frac{-b \pm \sqrt{b^2} - 4ac}{2a}$ D. $\frac{b}{2a} \pm \sqrt{b^2 - 4ac}$

15. SOLVE: $x^2 - 6x - 7 = 0$

16. SOLVE: $8y^2 - 2y - 1 = 0$

17. SOLVE: $5x^2 + 7x = -2$

18. Without solving the equation, tell the sum of the roots of $5x^2 - 7x + 15 = 0$.

19. Without solving the equation, tell the product of the roots of $3x^2 - 5x - 9 = 0$.

20. Write in standard form a quadratic equation whose roots are 3 and -5.

21. SOLVE: $\sqrt[3]{x - 1} = 3$

22. SOLVE: $\sqrt{7x + 4} = 5$

23. SOLVE: $\sqrt{x - 5} = x - 7$

UNIT V

Real Numbers

PART III
Test A B C

NAME______________________________ SECTION__________

TEACHER______________________________ DATE__________

SCORE______________________________ PERIOD__________

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UNIT VI **Complex Numbers** Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Write i in radical form.

2. i^{10} = ___________

   A. 1

   B. -1

   C. i

   D. -i

   E. None of these.

3. Identify the pure imaginary numbers:

   I. 2i

   II. 7 + 6i

   III. -3i

   IV. 2 - 5i

   V. 3

   A. Only I and III.

   B. Only I, II, III, and IV.

   C. All of these.

   D. None of these.

In Problems 4 through 6, write the expression in i - form:

4. $\sqrt{-7}$

5. $\sqrt{-4}$

6. $\sqrt{-27}$

In Problems 7-15, perform the indicated operations. Express the result in simplest form:

7. $\sqrt{-3} \cdot \sqrt{-5}$

8. $\sqrt{-16} \cdot \sqrt{-9}$

9. $5i \cdot 2i \cdot 7i$

10. $\dfrac{\sqrt{-15}}{\sqrt{-5}}$

11. $\dfrac{-5\sqrt{-3}}{2\sqrt{-6}}$

12. $\sqrt{-\frac{1}{4}} \cdot \sqrt{-16}$

13. $\sqrt{-4} + \sqrt{-9} + \sqrt{-25}$

14. $\sqrt{-98} - \sqrt{-50}$

15. $-\sqrt{-\frac{5}{4}} - \sqrt{-\frac{1}{5}}$

16. FIND THE SOLUTION SET: $x^2 + 36 = 0$

17. FIND THE SOLUTION SET: $16x^2 + 25 = 0$

18. Which of the following are complex numbers?

    I. 3π
    II. $2 + 4i$
    III. 0
    IV. $\sqrt{3} - \sqrt{2i}$
    V. $5i$

    A. Only II and IV.
    B. Only II, IV, and V.
    C. All of these.
    D. None of these.

19. Plot $2 - 3i$ on the diagram provided on the answer sheet.

20. TRUE or FALSE: $7 + 5i = 7 - 5i$

21. SOLVE FOR b: $a + bi = -5i - 2$

22. The additive inverse of $7 - 3i$ is:

A. $7 + 3i$ C. $-7 + 3i$

B. $-7 - 3i$ D. None of these.

23. The additive identity element in the set of complex numbers is__________.

24. The multiplicative identity element in the set of complex numbers is__________.

25. The complex conjugate of $3 + 4i$ is:

A. $-3 + 4i$ C. $-3 - 4i$

B. $3 - 4i$ D. None of these.

26. The multiplicative inverse of $3 + i$ is:

A. $\frac{3}{10} + \frac{1}{10}$ C. $\frac{3}{10} - \frac{1}{10}i$

B. $-3 - i$ D. None of these.

In Problems 27 through 30, perform the indicated operations and express the result in $a + bi$ form:

27. $(\sqrt{2} + 3i) - (\sqrt{2} - 4i)$

28. $(2 - 5i)(2 + 5i)$

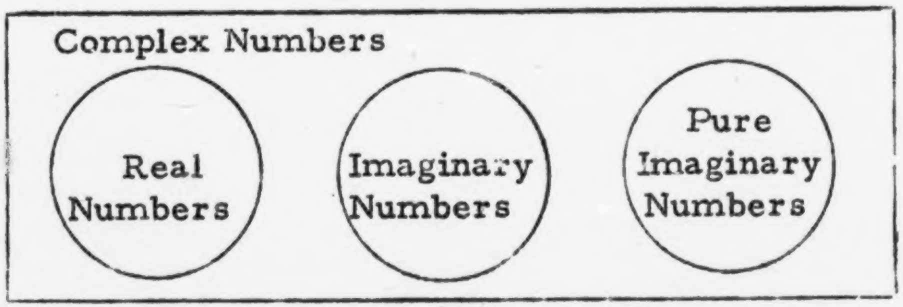
29. $(3 + 4i)^2$

30. $\frac{5 - 2i}{5 + 2i}$

31. TRUE or FALSE: The set of complex numbers is not closed under the operation of subtraction.

32. TRUE or FALSE: $2 + 3i < 5 + 7i$

33. TRUE or FALSE: The following Venn diagram illustrates the set of complex numbers and the relationships of some of its subsets.



34. FIND THE SOLUTION SET: $x^2 - 2x + 5 = 0$

35. The equation $7b^2 - 5b + 2 = 0$ has:

A. One real solution.
B. Two real solutions.
C. Two imaginary solutions.

36. The equation $2d^2 + 7d + 6 = 0$ has:

A. One real solution.
B. Two real solutions.
C. Two imaginary solutions.

UNIT VI **Complex Numbers** Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Write i in radical form.

2. $i^7 =$ ____________

   A. i
   B. $-i$
   C. 1
   D. -1
   E. None of these.

3. Identify the pure imaginary numbers:

   I. $7i$
   II. $6 - 2i$
   III. $-5i$
   IV. $2 + 5i$
   V. 4

   A. Only II and IV.
   B. None of these.
   C. All of these.
   D. Only I and III.

In Problems 4 through 6 write the expression in i form.

4. $\sqrt{-5}$

5. $\sqrt{-9}$

6. $\sqrt{-8}$

Perform the indicated operations 7 through 15. Express the result in simplest form.

7. $\sqrt{-3} \cdot \sqrt{-7}$

8. $(\sqrt{-3})^2$

9. $3i \cdot 5i \cdot 2i$

10. $\frac{\sqrt{-6}}{\sqrt{-2}}$

11. $\frac{9\sqrt{-2}}{4\sqrt{-3}}$

12. $(6\sqrt{-\frac{4}{3}})(\sqrt{3})$

13. $\sqrt{-4} + \sqrt{-16} - \sqrt{-25}$

14. $\sqrt{-20} + \sqrt{-12}$

15. $\sqrt{-\frac{3}{4}} - \sqrt{-\frac{1}{3}}$

16. FIND THE SOLUTION SET: $x^2 + 49 = 0$

17. FIND THE SOLUTION SET: $4x^2 + 25 = 0$

18. Which of the following are complex numbers?

I.	$\sqrt{3}$	IV.	$-3i$
II.	π	V.	0
III.	$2 + 5i$		

A. None of these.

B. All of these.

C. Only III and IV.

D. Only III.

19. Plot $-3 + 2i$ on the diagram provided on the answer sheet.

20. TRUE or FALSE: $\sqrt{3} + 2i = 2i + \sqrt{3}$

21. SOLVE FOR a: $a + bi = -bi - 3$

22. The additive inverse of $6 - 2i$ is:

A.	$6 + 2i$	C.	$-6 - 2i$
B.	$2i - 6$	D.	None of these.

23. The multiplicative identity element in the set of complex numbers is ________________.

24. The additive identity element in the set of complex numbers is ________________.

25. The complex conjugate of $2 + 3i$ is:

A. $-2 + 3i$ C. $2 - 3i$

B. $-2 - 3i$ D. None of these.

26. The multiplicative inverse of $2 + 3i$ is:

A. $\frac{2}{13} + \frac{3}{13}i$ C. $\frac{2}{13} - \frac{3}{13}i$

B. $-2 - 3i$ D. None of these.

In Problems 27 through 30 perform the indicated operations and express the result in $a + bi$ form.

27. $(-4 - 6i) + (-10 - 12i)$

28. $(-3 - \sqrt{-2})(-3 + \sqrt{-2})$

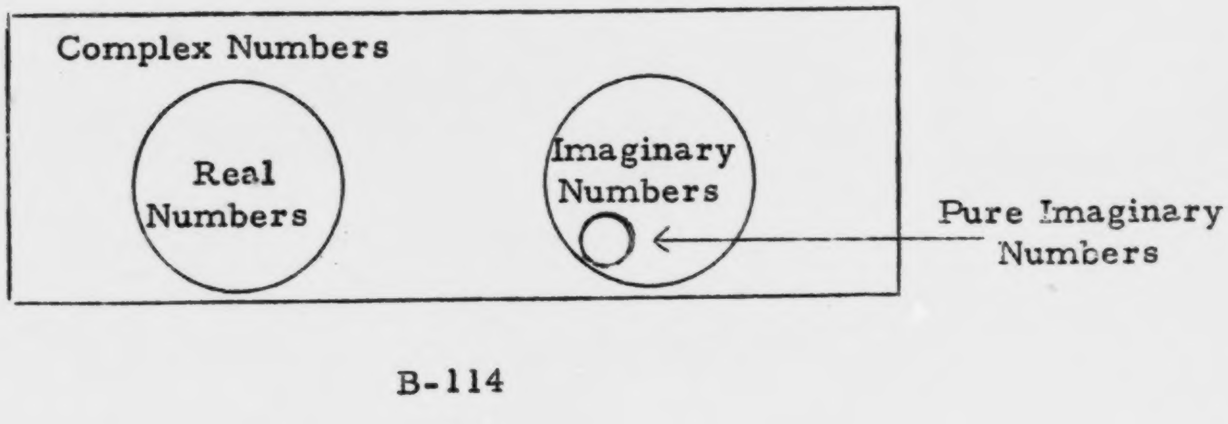
29. $(2 + 5i)^2$

30. $\dfrac{\sqrt{2} - \sqrt{3i}}{\sqrt{2} + \sqrt{3i}}$

31. TRUE or FALSE: The set of complex numbers is closed under the operation of addition.

32. TRUE or FALSE: $7 - 3i > 2 - 8i$

33. TRUE or FALSE: The following Venn diagram illustrates the set of complex numbers and the relationships of some of its subsets.



34. FIND THE SOLUTION SET: $x^2 - 4x + 5 = 0$

35. The equation $2x^2 - 3x = 2$ has:

A. One real solution. B. Two real solutions.

C. Two imaginary solutions.

36. The equation $x^2 - 6x + 12 = 0$ has:

A. One real solution. B. Two real solutions.

C. Two imaginary solutions.

UNIT VI Complex Numbers Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Write i in radical form.

2. $i^8 =$ __________

   A. 1
   B. -1
   C. i
   D. -i
   E. None of these.

3. Identify the pure imaginary numbers.

   I. 5
   II. 7i
   III. -i
   IV. 4 + 3i
   V. 6 - 7i

   A. Only I.

   B. Only II, III.

   C. Only IV, V.

   D. All of these.

   E. None of these.

In Problems 4 through 6, write the expression in i - form.

4. $\sqrt{-3}$

5. $\sqrt{-81}$

6. $\sqrt{-50}$

In Problems 7-15, perform the indicated operations. Express the result in simplest form:

7. $\sqrt{-2} \cdot \sqrt{-32}$

8. $\sqrt{-5} \cdot \sqrt{-10}$

9. $6i \cdot 5i \cdot 4i$

10. $\dfrac{\sqrt{-18}}{\sqrt{-2}}$

11. $\dfrac{-3\sqrt{-2}}{2\sqrt{-5}}$

12. $(10\sqrt{-\frac{6}{5}})(\sqrt{10})$

13. $\sqrt{-81} + \sqrt{-9} + \sqrt{-36}$

14. $\sqrt{-40} + \sqrt{20}$

15. $\sqrt{-\frac{2}{3}} - \sqrt{-\frac{1}{5}}$

16. FIND THE SOLUTION SET: $x^2 + 100 = 0$

17. FIND THE SOLUTION SET: $4x^2 + 81 = 0$

18. Which of the following are complex numbers?

I. $\sqrt{27}$
II. $\sqrt{-5}$
III. $2i$
IV. 0
V. $5 + 2i$

A. Only II.

B. Only II, V.

C. Only II, III, V.

D. Only I, II, III, V.

E. All of these.

19. Plot $-2 + 3i$ on the diagram provided on the answer sheet.

20. TRUE or FALSE: $\sqrt{5} + 2i = 2i + \sqrt{5}$

21. SOLVE FOR b: $a + bi = -7i + 1$

22. The additive inverse of $-6 + 3i$ is:

A. $6 - 3i$

B. $-6 + 3i$

C. $-6 - 3i$

D. $-6 + 3i$

23. The multiplicative identity element in the set of complex numbers is ______________________.

24. The additive identity element in the set of complex numbers is ____________.

25. The complex conjugate of $4 + 5i$ is:

A. $4 - 5i$

B. $-4 + 5i$

C. $-4 - 5i$

D. $4 + 5i$

26. The multiplicative inverse of $4 + 5i$ is:

A. $4 - 5i$

B. $-4 - 5i$

C. $\frac{4}{41} - \frac{5i}{41}$

D. None of these.

In Problems 27 through 30, perform the indicated operations and express the result in $a + bi$ form.

27. $(-6 + 2i) - (-5 - 4i)$

28. $(-5 + \sqrt{-3})(-5 - \sqrt{-3})$

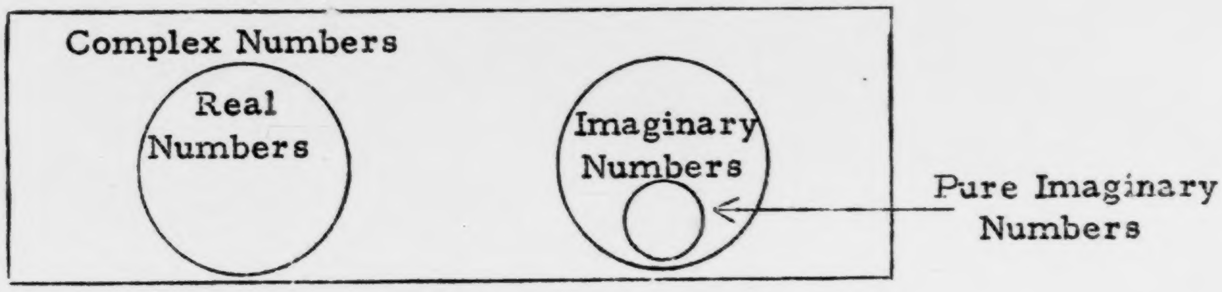
29. $(2 - 5i)^2$

30. $\frac{\sqrt{2} + 3i}{\sqrt{2} - 3i}$

31. TRUE or FALSE: The set of complex numbers is closed under the operation of multiplication.

32. TRUE or FALSE: $7 - 2i > 3 - 9i$

33. TRUE or FALSE: The following Venn diagram illustrates the set of complex numbers and the relationships of some of its subsets.



34. FIND THE SOLUTION SET: $x^2 - 5x + 7 = 0$

35. The equation $3x^2 - 2x = 5$ has:

A. One real solution.

B. Two real solutions.

C. Two imaginary solutions.

36. The equation $x^2 - 6x + 10 = 0$ has:

A. One real solution.

B. Two real solutions

C. Two imaginary solutions.

UNIT VI Complex Numbers Test A B C

NAME ______________________ SECTION __________

TEACHER ______________________ DATE __________

SCORE ______________________ PERIOD __________

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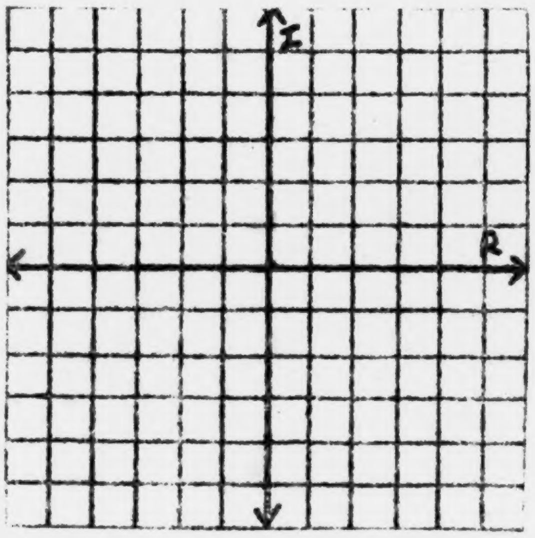
19.



20. ______________
21. ______________
22. ______________
23. ______________
24. ______________
25. ______________
26. ______________
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32. ______________
33. ______________
34. ______________
35. ______________
36. ______________

UNIT VII Logarithms Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on answer sheet. Do not spend too much time on any one problem.

1. COMPLETION: $\text{Log}_b a = n$ if and only if ____________________.

2. TRUE or FALSE: 1 can be the base for a system of logarithms.

In Problems 3 through 6, write the exponential statements in logarithmic form.

3. $3^4 = 81$

4. $(\frac{1}{4})^{-2} = 16$

5. $(36)^{\frac{1}{2}} = 6$

6. $(49)^{-\frac{1}{2}} = \frac{1}{7}$

In Problems 7 through 9, write the logarithmic statements in exponential form.

7. $\text{Log}_2 16 = 4$

8. $\text{Log}_{\frac{1}{3}} 27 = -3$

9. $\text{Log}_4 \frac{1}{16} = -2$

10. YES or NO: Does 3 have a logarithm in all permissible bases?

11. YES or NO: Does -2 have a logarithm in base 10?

12. YES or NO: Is there a base in which -2 has a logarithm?

13. What is the greatest possible error in a measurement of 3 pounds?

14. Find the accuracy of a measurement of 25 feet.

15. What is the precision in a measurement of .007 grams?

16. How many significant digits are there in the number 532?

17. How many significant digits are there in the number 7.04?

18. How many significant digits are there in the number .009?

Write each of the following numbers in standard notation. In doubtful cases, assume zeros to be insignificant.

19. 245,000

20. .00000507

In Problems 21 and 22, write the following numbers in decimal notation.

21. 7.43×10^{-4}

22. 1.2×10^{5}

23. Perform the indicated operation. Leave answer in decimal form.

$$\frac{(12 \times 10^{8}) \times (3 \times 10^{-3})}{4 \times 10^{5}}$$

24. Log 835 = 2.9217. Write the mantissa of the logarithm.

Using the table in the back of the text, write the logarithm of each number in Problems 25 through 28.

25. 845

26. 32.4

27. 50400

28. .00138

29. Use the table in the back of the text and interpolation to write the logarithm of 15.48.

Using the table in the back of the text. Write the antilogarithm of each number in Problems 30 through 32.

30. 2.7875

31. 7.9279 - 10

32. 3.8024

33. Which of the following statements are always true?

I. $\log ab = (\log a)(\log b)$

II. $\log a^n = n \log a$

III. $\log \frac{a}{b} = \log a - \log b$

A. I, II, III

B. Only I, III

C. Only II, III

D. Only II

E. None of these

In Problems 34 through 37, use logarithms to perform each of the following operations.

34. $.732 \times 1730$

35. $\frac{70.5}{571.0}$

36. $(7.2)^4$

37. $(16.2)^{\frac{1}{3}}$

In Problems 38 and 39, find approximate solutions using logarithms. Leave answers correct to nearest hundredth.

38. $x^{\frac{3}{5}} = 2.32$

39. $2^x = 14$

UNIT VII **Logarithms** Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on answer sheet. Do not spend too much time on any one problem.

1. COMPLETION: $\mathrm{Log}_b a = n$ if and only if ________________.

2. TRUE or FALSE: Zero can be the base for a system of logarithms.

In Problems 3 through 6, write the exponential statements in logarithmic form.

3. $5^3 = 125$

4. $(\frac{1}{3})^{-3} = 27$

5. $(64)^{\frac{1}{3}} = 4$

6. $(8)^{-\frac{1}{3}} = \frac{1}{2}$

In Problems 7 through 9 write the logarithmic statements in exponential form.

7. $\mathrm{Log}_3 27 = 3$

8. $\mathrm{Log}_{36} 6 = \frac{1}{2}$

9. $\mathrm{Log}_{27} \frac{1}{3} = -\frac{1}{3}$

10. YES or NO: Does 12 have a logarithm in all permissible bases?

11. YES or NO: Does -4 have a logarithm in base 2?

12. YES or NO: Is there a base in which -4 has a logarithm?

13. What is the greatest possible error in a measurement of 5 inches?

14. Find the accuracy of a measurement of 10 ounces.

15. What is the precision in a measurement of 2.03 gram.

16. How many significant digits are there in the number 324?

17. How many significant digits are there in the number 54.03?

18. How many significant digits are there in the number .023?

Write each of the following numbers in standard notation. In doubtful cases, assume zeros to be insignificant.

19. 30,200

20. .000000705

In Problems 21 and 22, write the following numbers in decimal notation.

21. 3.52×10^{3}

22. 8.09×10^{-2}

23. Perform the indicated operation. Leave answer in decimal form.

$$\frac{(19 \times 10^{6}) \times (2 \times 10^{-2})}{6 \times 10^{3}}$$

24. Log 7280 = 3.8621. Write the mantissa of the logarithm.

Using the table in the back of the text, write the logarithm of each number in Problems 25 through 28.

25. 263

26. 44.3

27. 604,000

28. 00853

29. Use the table in the back of the text and interpolation to write the logarithm of 7.903.

Using the table in the back of the text. Write the antilogarithm of each number in Probelms 30 through 32.

30. 1.4728

31. 5.8982 - 10

32. 2.3438

33. Which of the following statements are always correct?

I. $\text{Log } ab = \log a + \log b$

II. $\text{Log } a^n = n \log a$

III. $\text{Log } \frac{a}{b} = (\log a) \div (\log b)$

A. I, II, III

B. Only II, III

C. Only I, III

D. Only III

E. None of the above.

In Problems 34 through 37, use logarithms to perform each of the following operations.

34. $.924 \times 334$

35. $\frac{407.0}{59.8}$

36. $(23.4)^5$

37. $(9.5)^{\frac{1}{4}}$

In Problems 38 and 39, find approximate solutions using logarithms. Leave answers correct to nearest hundredth.

38. $x^{\frac{3}{4}} = 7.12$

39. $3^x = 15$

UNIT VII **Logarithms** Test C

DIRECTIONS: Do not write on this paper. Do all scratch work on the paper provided for this purpose. Place all answers on answer sheet. Do not spend too much time on any one problem.

1. COMPLETION: $\text{Log}_b\, a = n$ if and only if _____________________.

2. TRUE or FALSE: 1 can never be the base for a system of logarithms.

In Problems 3 through 6, write the exponential statements in logarithmic form.

3. $5^3 = 125$

4. $(-\frac{1}{3})^{-3} = -27$

5. $(49)^{\frac{1}{2}} = 7$

6. $(8)^{-\frac{1}{3}} = \frac{1}{2}$

In Problems 7 through 9, write the logarithmic statements in exponential form.

7. $\text{Log}_3 81 = 4$

8. $\text{Log}_{49} \frac{1}{7} = -\frac{1}{2}$

9. $\text{Log}_{\frac{1}{4}} 16 = -2$

10. YES or NO: Does 6 have a logarithm in all permissible bases?

11. YES or NO: Does -3 have a logarithm in base 5?

12. YES or NO: Is there a base in which -3 has a logarithm?

13. What is the greatest possible error in a measurement of 14 ounces?

14. Find the accuracy of a measurement of 20 grams.

15. What is the precision in a measurement of .0225 kilograms?

16. How many significant digits are there in the number 132?

17. How many significant digits are there in 1.032?

18. How many significant digits are there in .00301?

Write each of the following numbers in standard notation. In doubtful cases, assume zeros to be insignificant.

19. 32,500

20. .0000302

In Problems 21 and 22, write the following numbers in decimal notation.

21. 2.31×10^5

22. 8.01×10^{-3}

23. Perform the indicated operation. Leave answer in decimal form.

$$\frac{(8 \times 10^7) \times (4 \times 10^{-3})}{16 \times 10^2}$$

24. Log 37.9 = 1.5786. Write the mantissa of the logarithm.

Using the table in the back of the text, write the logarithm of each number in Problems 25 through 28.

25. 513

26. 85.3

27. 3020

28. .000204

29. Use the table in the back of the text and interpolation to write the logarithm of 836.8.

Using the table in the back of the text, write the antilogarithm of each number in Problems 30 through 32.

30. 0.8028

31. 9.6107 - 10

32. 2.8705

33. Which of the following statements are always correct?

I. $\log ab = \log a + \log b$

II. $\log a^n = n \log a$

III. $\log \frac{a}{b} = \log a - \log b$

A. I, II, III

B. Only I and III

C. Only II and III

D. Only I

E. None of the above.

In Problems 34 through 37, use logarithms to perform each of the following operations.

34. $234 \times .0133$

35. $\frac{3.94}{362.0}$

36. $(3.2)^5$

37. $(25.3)^{\frac{1}{4}}$

In Problems 38 and 39, find approximate solutions using logarithms. Leave answers correct to nearest hundredth.

38. $y^{\frac{3}{5}} = 1.42$

39. $3^y = 12$

UNIT VII **Logarithms** Test A B C

NAME ______________________ SECTION ____________

TEACHER ______________________ DATE ____________

SCORE ______________________ PERIOD ____________

1. ____________
2. ____________
3. ____________
4. ____________
5. ____________
6. ____________
7. ____________
8. ____________
9. ____________
10. ____________
11. ____________
12. ____________
13. ____________
14. ____________
15. ____________
16. ____________
17. ____________
18. ____________
19. ____________
20. ____________
21. ____________
22. ____________
23. ____________
24. ____________
25. ____________
26. ____________
27. ____________
28. ____________
29. ____________
30. ____________
31. ____________
32. ____________
33. ____________
34. ____________
35. ____________
36. ____________
37. ____________
38. ____________
39. ____________

UNIT VIII Progressions and the Binomial Expansion PART I
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Which of the following are arithmetic progressions?

   I. $2, 1, \frac{1}{2}, \frac{1}{4}$ III. 2, 4, 6, 8

   II. 5, 2, -1, -4 IV. 3, 7, 11, 15

   A. Only I.

   B. Only II, III, and IV.

   C. All of these.

   D. None of these.

2. The next term in the arithmetic progression 3, -1, -5, ... is____________.

3. For the arithmetic progression 6, 10, 14, 18, the common difference is ______________________.

4. If the first term of an arithmetic progression is 3 and the common difference is 8, write the first four terms of the progression.

5. The formula for the n^{th} term of an arithmetic progression is____________.

6. The twentieth term of 10, 7, 4, ... is __________________.

7. The thirteenth term of 7, 11, 15, ... is ____________________.

8. Insert five arithmetic means between 3 and 21.

9. Find the sum of the first 8 terms of the arithmetic progression -1, 3, 7, 11... .

10. Find the first three terms of the arithmetic progression where $a = 8$, $l = 408$, and $s_n = 2288$.

11. Find the sum of the arithmetic series $\sum_{i=2}^{4} 4i$

12. Which of the following are geometric progressions?

I. 63, 34, 0, -34

II. 2, -2, -2, 2

III. $\frac{1}{27}, -\frac{1}{9}, \frac{1}{3}, -1$

IV. 4, 8, 16, 32

A. All of these.

B. None of these.

C. Only II.

D. Only III and IV.

13. The common ratio in the geometric progression 6, 18, 54, 162 is __________________________.

14. Find the first four terms of the geometric progression whose first term is -5 and whose common ratio is -2.

15. The formula for the n^{th} term of a geometric progression is ________________.

16. If the first term of a geometric progression is $\frac{1}{16}$ and the common ratio is -2, then the fifth term is:

A. $\frac{1}{8}$

B. $-\frac{1}{8}$

C. 1

D. -1

E. $\frac{1}{2}$

17. What is the positive mean proportional of 6 and 24?

18. Find two geometric means between 5 and 135.

19. If $r \neq 1$, which of the following formulas give(s) the sum of a geometric series?

I. $s_n = \frac{a - rl}{r - 1}$

II. $s_n = \frac{a - ar^n}{1 - r}$

III. $s_n = \frac{a(r^n - 1)}{r - 1}$

A. I only.

B. II only.

C. III only.

D. I, III only.

E. II, III only.

20. In a geometric series, if a = 5, r = 3, and n = 4, then s_n = ____________.

A. -400

B. 400

C. -200

D. 200

E. 100

UNIT VIII

Progressions and the Binomial Expansion

PART I
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Which of the following are arithmetic progressions?

   I. 1, 8, 27, 64
   II. -2, -1, 0, 1
   III. 2, 5, 8, 11
   IV. $2, -1, \frac{1}{2}, -\frac{1}{4}$
   V. $1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}$

   A. Only I, IV and V.
   B. All of these.
   C. None of these.
   D. Only II and III.

2. The next term in the arithmetic progression -7, -1, 5... is __________.

3. For the arithmetic progression 13, 7, 1,... the common difference is ________________.

4. If the first term of an arithmetic progression is 12, and the common difference is 7, write the first four terms of the progression.

5. The formula for the n^{th} term of an arithmetic progression is __________.

6. The 18th term of 18, 14, 10 is _____________.

7. The 9th term of 8, 11, 14 is _____________.

8. Insert 3 arithmetic means between 16 and -12.

9. Find the sum of the first eight terms of the arithmetic progression 3, 5, 7, ...

10. Find the first 3 terms of the arithmetic progression where $a = 3$, $l = -99$ and $s_n = -2496$.

11. Find the sum of the arithmetic series $\sum_{i=8}^{10} (i + 4)$

12. Which of the following are geometric progressions?

I. 3, 24, 202, 1616

II. -1, 1, -1, 1

III. 4, 8, 12, 16

IV. 6, 3, $1\frac{1}{2}$, $\frac{3}{4}$

V. 9, 6, 3, 0

A. Only I, II and IV.

B. All of these.

C. None of these.

D. Only II and IV.

13. The common ratio in the geometric progression -3, 6, -12, 24 is ____________________.

14. Find the first four terms of geometric progression whose first term is -2 and whose common ratio is 5.

15. The formula for the n^{th} term of a geometric progression is _____________.

16. If the first term a geometric progression is 3, and the common ratio r is -2, then the fifth term is:

A. 96

B. -96

C. 48

D. -48

E. -24

17. What is the positive mean proportional of 9 and 16?

18. Find two geometric means between 3 and 375.

19. If $r \neq 1$, which of the following formulas give(s) the sum of a geometric progression?

I. $S_n = \frac{a - ar^n}{1 - r}$

II. $S_n = \frac{a(r^n - 1)}{r - 1}$

III. $S_n = \frac{a - lr}{r - 1}$

A. I only.

B. II only.

C. III only.

D. I, II only.

E. II, III only.

20. In a geometric series, if $a = 6$, $r = 2$, and $n = 6$, $S_n =$ ________________.

A. 378

B. -378

C. 384

D. -384

E. 372

UNIT VIII

Progressions and the Binomial Expansion

PART I
Test C

DIRECTIONS: Do not write on the test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Which of the following are arithmetic progressions?

   I. $2, 1, \frac{1}{2}, \frac{1}{4}$

   II. $1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}$

   III. $-2, -1, 0, 1$

   IV. $3, 7, 11, 15$

   A. Only IV.

   B. Only III and IV.

   C. All of these.

   D. None of these.

2. The next term in the arithmetic progression 2, -1, -4, . . . is __________.

3. For the arithmetic progression 68, 61, 54, the common difference is __________.

4. If the first term of an arithmetic progression is 2 and the common difference is 7, write the first four terms of the progression.

5. The formula for the n^{th} term of an arithmetic progression is __________.

6. The seventeenth term of 51, 44, 37 is __________.

7. The twentieth term of 8, 11, 14 is __________.

8. Insert nine arithmetic means between -15 and -5.

9. Find the sum of the first 15 terms of the arithmetic progression 5, 11, 17... .

10. Find the first three terms of the arithmetic progression where $a = 3$, $l = -99$, and $S_n = -2496$.

11. Find the sum of the arithmetic series $\sum_{i=3}^{5} 6i$

12. Which of the following are geometric progressions?

I. $\frac{1}{27}, -\frac{1}{9}, \frac{1}{3}, -1$

II. 63, 34, 0, -34

III. 4, 8, 16, 32

IV. 2, -2, -2, 2

A. All of these.

B. None of these.

C. Only I and III.

D. Only IV.

13. The common ratio in the geometric progression 3, -9, 27, -81 is ______________.

14. Find the first six terms of the geometric progression whose first term is 9 and whose common ratio is -2.

15. The formula for the n^{th} term of a geometric progression is ____________.

16. If the first term of a geometric progression is $\frac{1}{16}$ and the common ratio is -4, then the fifth term is:

A. $\frac{1}{4}$

B. $-\frac{1}{4}$

C. 16

D. -16

17. What is the positive mean proportional of 6 and 24?

18. Find two geometric means between 3 and 375.

19. If $r \neq 1$, which of the following formulas give(s) the sum of a geometric series?

I. $\frac{a(r^n - 1)}{r - 1}$

II. $S_n = \frac{a - rl}{r - 1}$

III. $S_n = \frac{a - ar^n}{1 - r}$

A. I only.

B. II only.

C. III only.

D. I and III only.

E. II and III only.

20. In a geometric series, if a = 10, r = 3 and n = 5, then S_n = ____________.

A. 210

B. 1210

C. 500

D. 700

UNIT VIII **Progressions and the Binomial Expressions** PART I
Test A B C D

NAME ________________________ SECTION __________

TEACHER ________________________ DATE __________

SCORE ________________________ PERIOD __________

1. ____________ 11. ____________
2. ____________ 12. ____________
3. ____________ 13. ____________
4. ____________ 14. ____________
5. ____________ 15. ____________
6. ____________ 16. ____________
7. ____________ 17. ____________
8. ____________ 18. ____________
9. ____________ 19. ____________
10. ____________ 20. ____________

UNIT VIII　　Progressions and the Binomial Expansion　　PART II
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Which of the following infinite geometric series has a sum?

I. $5 + 10 + 20 + 40 + \dots$

II. $\frac{1}{3} + \frac{1}{6} + \frac{1}{12} + \frac{1}{24} + \dots$

III. $3 - 3 + 3 - 3 + \dots$

A. II only.

B. I and III only.

C. None of these.

D. All of these.

2. The sum of the infinite geometric series
$- 32 + 16 - 8 + 4 - 2 + 1 - \frac{1}{2} + \dots$ is ____________________.

3. The value of .555... is:

A. $\frac{1}{2}$

B. .55

C. $\frac{5}{9}$

D. None of these.

4. Given two complete rows of Pascal's Triangle:

1　4　6　4　1
1　5　10　10　5　1
1　6　?

the number which replaces ___?___ in the next row is:

A. 7

B. 20

C. 5

D. 15

E. No way to determine number.

5. Use the correct row of that part of Pascal's Triangle given in Problem 4 to expand $(a + b)^4$.

6. The expansion of $(x - 2y)^5$ is:

A. $x^5 - 5x^4y + 10x^3y^2 - 10x^2y^3 + 5xy^4 - y^5$

B. $x^5 - 10x^4y + 40x^3y^2 - 80x^2y^3 + 80xy^4 - 32y^5$

C. $x^5 - 10x^4y + 40x^3y^2 - 80x^2y^3 + 80xy^4 - 40y^5$

D. None of these.

7. The fifth term in the expansion of $(x + y)^{10}$ is ________________.

8. 0! = ________

9. 1! = ________

10. The value of $\frac{8!}{6!\,2!}$ is:

A. $\frac{4}{3}$

B. 1

C. 28

D. None of these.

UNIT VIII **Progressions and the Binomial Expansion** PART II
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Which of the following infinite geometric series has a sum?

I. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots$

II. $3 + 9 + 27 + 81 \ldots$

III. $-2 + 2 - 2 + \ldots$

A. I only.

B. II and III.

C. None of these.

D. All of these.

2. The sum of the infinite geometric series

$-1 - \frac{1}{2} - \frac{1}{4} - \frac{1}{8} - \frac{1}{16} - \frac{1}{32} - \ldots$ is ____________.

3. The value of .777... is ____________.

A. $\frac{7}{10}$

B. $\frac{7}{9}$

C. .77

D. None of these.

4. Given two complete rows of Pascal's Triangle:

1 5 10 10 5 1
1 6 15 20 15 6 1
1 7 _?_

the number which replaces _?_ in the next row is:

A. 8

B. 21

C. 6

D. 35

E. No way to determine this number.

5. Use the correct row of that part of Pascal's Triangle given in Problem 4 to expand $(a + b)^5$.

6. The expansion of $(x - 2y)^4$ is ____________.

A. $x^4 - 8x^3y - 12x^2y^2 - 32xy^3 - 16y^4$

B. $x^4 - 8x^3y + 12x^2y^2 - 36xy^3 + 16y^4$

C. $x^4 - 4x^3y + 6x^2y^2 - 4xy^3 + y^4$

D. $x^4 - 8x^3y + 12x^2y^2 - 32xy^3 + 16y^4$

E. None of these.

7. The sixth term in expansion of $(a + b)^{11}$ is ____________.

8. $0! =$ ________

9. $1! =$ ________

10. The value of $\frac{10!}{5!\,3!}$ is ____________.

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. 5040

D. None of these.

UNIT VIII **Progressions and the Binomial Expansion** PART II
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Which of the following infinite geometric series has a sum?

   I. $2 + \frac{2}{5} + \frac{2}{25} + \frac{2}{125} + \ldots$

   II. $1 - 1 + 1 - 1 + \ldots$

   III. $1 + 5 + 25 + 125 + \ldots$

   A. I only.

   B. I and III only.

   C. None of these.

   D. I, II, and III.

2. The sum of the infinite geometric series $- 12 + 3 - \frac{3}{4} + \frac{3}{16} - \ldots$ is ________________.

3. The value of .777... is:

   A. $\frac{7}{9}$

   B. $\frac{7}{10}$

   C. .777

   D. None of these.

4. Given two complete rows of Pascal's Triangle:

   1 5 10 10 5

   1 6 15 20 15 6

   1 7 ?

   the number which replaces ? in the next row is:

   A. 8

   B. 21

   C. 35

   D. 6

   E. No way to determine number.

5. Use the correct row of that part of Pascal's Triangle given in Problem 4 to expand $(a + b)^5$.

6. The expansion of $(x - 2y)^5$ is:

A. $x^5 - 10x^4y + 40x^3y^2 - 80x^2y^3 + 80xy^4 - 40y^5$

B. $x^5 - 5x^4y + 10x^3y^2 - 10x^2y^3 + 5xy^4 - y^5$

C. $x^5 - 10x^4y + 40x^3y^2 - 80x^2y^3 + 80xy^4 - 32y^5$

D. None of these.

7. The seventh term in the expansion of $(x + y)^{10}$ is ______________.

8. $1! =$ ________

9. $0! =$ ________

10. The value of $\frac{8!}{6!\,2!}$ is:

A. 28

B. $\frac{4}{3}$

C. 1

D. None of these.

UNIT VIII Progressions and the Binomial Expansion PART II
Test A B C D

NAME____ SECTION_______

TEACHER ______________________________________ DATE_________

SCORE____ PERIOD_______

1. ________________________
2. ________________________
3. ________________________
4. ________________________
5. ________________________
6. ________________________
7. ________________________
8. ________________________
9. ________________________
10. ________________________

UNIT IX

Permutations, Combinations, and Probability

PART I
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. If $A = \{1, 3, 5\}$ and $B = \{2, 4, 6, 8\}$, then the number of ordered pairs (a, b) in the Cartesian product $A \times B$, where $a \in A$ and $b \in B$, is:

   A. 3
   B. 4
   C. 7
   D. 12
   E. 9

2. Which one of the following ordered pairs does not belong to $A \times B$ of Problem 1?

   A. (1,2)
   B. (8,3)
   C. (5,4)
   D. (1,6)
   E. (3,4)

3. If $C = \{2, 3, 5, 8\}$ and $D = \{1, 4, 6, 8, 9, 10\}$, then the number of elements in $C \cup D$ is:

   A. 1
   B. 4
   C. 6
   D. 9
   E. 10

4. The number of even positive integers between 101 and 501 which contain only digits belonging to $\{2, 7, 3\}$ is:

   A. 9
   B. 6
   C. 27
   D. 12
   E. 18

5. The number of different telephone numbers which can be formed using seven digits, the first of which is not zero, is:

   A. 6×7^6
   B. 9×10^6
   C. 7^7
   D. 10^7
   E. None of these.

6. TRUE or FALSE: Any arrangement of the members of a set in a definite orders is called a permutation of the set.

7. ${}_{n}P_{n}$ = ________ .

8. The number of ways in which 6 different books can be placed on a shelf, side by side, is:

A. 20
B. 15
C. 120
D. 60
E. 720

9. The number of ways in which 7 people can be seated around a circular table is:

A. 6
B. 120
C. 7
D. 5040
E. 720

10. The number of ways in which 3 cars can park in 6 parking spaces is:

A. 9
B. 6
C. 20
D. 60
E. 120

11. The number of distinguishable permutations of the letters of the word ALABAMA is:

A. 7!
B. 7! - 4!
C. $\frac{7!}{4!}$
D. None of these.

12. The number of signals which can be made by displaying 4 white flags and 3 blue flags on a pole at the same time is:

A. 1
B. 7
C. 7!
D. 35
E. None of these.

13. The number of subsets of $\{1, 2, 3, 4, 5, 6\}$ which contain 4 elements is:

A. 4
B. 6
C. 15
D. None of these.

14. $_5C_2$ = ________.

A. 5!

B. $\frac{5!}{2!\,3!}$

C. $\frac{5!}{2!}$

D. None of these.

15. $_nC_r$ = ________.

16. The numbers of ways a committee of 7 can be chosen from 10 individuals is:

A. $_8P_3$

B. 120

C. 720

D. None of these.

17. Seven points lie on the circumference of a circle. How many chords can be drawn joining any two of the seven points?

A. 7

B. 42

C. 21

D. None of these.

18. A committee of 7 is to be composed of 4 seniors and 3 juniors. The number of choices if 7 seniors and 8 juniors are available for appointment is ____________.

A. $_8C_3 \cdot {_7C_4}$

B. $_{15}C_{10}$

C. $_7C_4 + {_8C_3}$

D. None of these.

19. The 6th term of $(x + y)^{10}$ is:

A. $_{10}C_5 x^5 y^5$

B. $_{10}C_6 x^6 y^4$

C. $_{10}C_4 x^4 y^6$

D. None of these.

20. The missing term in the following portion of Pascal's Triangle is ________.

1
1 1
1 2 1
1 3 3 1
1 4 6 ? 1

A. $_4C_2$

B. $_4C_3$

C. $_4C_0$

D. $_4C_4$

UNIT IX

Permutations, Combinations, and Probability

PART I
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. If $A = \{2, 3, 5, 7\}$ and $B = \{2, 4, 6\}$, then the number of ordered pairs (a, b) in the Cartesian product $A \times B$, where $a \in A$ and $b \in B$ is:

   A. 4
   B. 7
   C. 3
   D. 9
   E. 12

2. Which of the following ordered pairs does not belong to $A \times B$ of Problem 1?

   A. (2, 2)
   B. (5, 4)
   C. (3, 6)
   D. (6, 7)
   E. (7, 4)

3. If $C = \{2, 3, 5, 11, 12, 13\}$ and $D = \{1, 3, 5, 6\}$, then the number of elements in $C \cup D$ is:

   A. 4
   B. 8
   C. 1
   D. 10
   E. 6

4. The number of odd positive integers between 100 and 1000 which contain only digits belonging to $\{2, 4, 5\}$ is:

   A. 12
   B. 9
   C. 13
   D. 27
   E. 15

5. The number of different license plate numbers which can be formed using two letters and four digits, where the letters 0 and I cannot be used, is:

   A. $24^2 \times 10^4$
   B. $24^2 \times 9^4$
   C. $24 \times 23 \times 10^4$
   D. None of these.

6. Any arrangement of the members of a set in a definite order is called a ________________ of the set.

7. $_{n}P_{n}$ = ________.

8. The number of ways in which 5 boys can be arranged in a column is:

A. 1

B. 20

C. 120

D. None of these.

9. The number of ways 6 people can be seated around a circular table is:

A. 6

B. 5

C. 120

D. 720

E. 60

10. The number of ways 2 students may be assigned to 8 seats is:

A. 4

B. 56

C. 112

D. None of these.

11. The number of distinguishable permutations of the letters of the word ARKANSAS is:

A. $\frac{8!}{3!\,2!}$

B. $\frac{8!}{5!}$

C. 8!

D. None of these.

12. The number of signals which can be made by arranging 9 flags in a line if 4 are red, 3 are white, and 2 are blue is:

A. 3

B. 1

C. $\frac{9!}{3!}$

D. $\frac{9!}{2!\,3!\,4!}$

E. None of these.

13. The number of subsets of $\{a, b, c, d, e\}$ which contain three elements is:

A. 5

B. 10

C. 3

D. None of these.

14. ${}_7C_3 =$ ________.

A. $7!$

B. $\frac{7!}{3!}$

C. 35

D. None of these.

15. ${}_nC_r =$ ________.

16. How many different committees of 3 people can be formed from a group of 8 people?

A. 56

B. ${}_8P_3$

C. 336

D. $8!$

E. None of these.

17. Five points lie on the circumference of a circle. How many chords can be drawn joining any two of the 5 points?

18. A class play has 4 parts for boys and 5 parts for girls. In the class there are 7 boys and 8 girls who are eligible. The number of ways in which the cast can be slected is________.

A. ${}_{15}C_9$

B. None of these.

C. ${}_7C_4 + {}_8C_5$

D. ${}_7C_4 \cdot {}_8C_5$

19. The 5th term of $(x + y)^9$ is:

A. ${}_9C_5\, x^5 y^4$

B. ${}_9C_4\, x^5 y^4$

C. ${}_9C_5\, x^4 y^5$

D. None of these.

20. The missing term in the following portion of Pascal's Triangle is _______.

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 $\underline{?}$ 10 5 1

A. ${}_5C_3$

B. ${}_5C_2$

C. ${}_5C_4$

D. ${}_5C_5$

UNIT IX — Permutations, Combinations, and Probability — PART I Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. If A = $\{2, 4, 6, 8, 10\}$ and B = $\{3, 5\}$, then the number of ordered pairs (a, b) in the Cartesian product A x B, where $a \in A$ and $b \in B$, is:

   A. 5
   B. 2
   C. 10
   D. 3
   E. None of these.

2. Which of the following ordered pairs do not belong to A x B of Problem 1?

   A. (4, 3)
   B. (5, 2)
   C. (6, 5)
   D. (2, 3)

3. If C = $\{3, 6, 9, 12\}$ and D = $\{2, 4, 6, 8, 10, 12\}$, then the number of elements in $C \cup D$ is:

   A. 4
   B. 8
   C. 1
   D. 6
   E. 10

4. The number of odd positive integers between 0 and 100 which contain only digits belonging to $\{3, 6, 9\}$ is:

   A. 6
   B. 3
   C. 12
   D. 27
   E. None of these.

5. The number of different telephone numbers which can be formed using seven digits, the first and fourth of which are not zero, is:

   A. 7^7
   B. $6^2 \times 7^5$
   C. 10^7
   D. $9^2 \times 10^5$
   E. None of these.

6. TRUE or FALSE: Any arrangement of the members of a set in a definite order is called a permutation of the set.

7. $_nP_n$ = ________.

8. The number of ways in which 7 different books can be placed on a shelf, side by side, is:

A. 1
B. 7!
C. 6!
D. 7
E. None of these.

9. The number of ways in which 5 people can be seated around a circular table is:

A. 24
B. 120
C. 720
D. 5
E. None of these.

10. The number of ways in which 3 people can be seated in 8 seats is:

A. 120
B. 11
C. 8
D. 336
E. None of these.

11. The number of distinguishable permutations of the letters of the word MINIMUM is:

A. $\frac{7!}{5!}$
B. $\frac{7!}{2!\,3!}$
C. 7!
D. None of these.

12. The number of signals which can be made by displaying 5 white flags, 2 red flags, and 3 blue flags on a pole at the same time is:

A. 5!2!3!
B. 10
C. $\frac{10!}{5!2!3!}$
D. 1
E. None of these.

13. The number of subsets of $\{2, 4, 6, 8, 10\}$ which contain 3 elements is:

A. 1
B. 5
C. 10
D. None of these.

14. ${}_6C_2 =$ ________.

A. $6!$

B. $\frac{6!}{2!\,4!}$

C. $\frac{6!}{2!}$

D. None of these.

15. ${}_nC_r =$ ________.

16. The number of ways a committee of 3 can be chosen from 10 individuals is:

A. 120

B. ${}_{10}P_3$

C. 720

D. None of these.

17. Six points lie on the circumference of a circle. How many chords can be drawn joining any two of the six points?

A. 14

B. 6

C. 15

D. None of these.

18. A committee of 9 is to be composed of 7 boys and 2 girls. The number of choices if 10 boys and 5 girls are available for appointment is ____________.

A. ${}_{15}C_9$

B. ${}_{10}C_7 \cdot {}_5C_2$

C. ${}_{10}C_7 + {}_5C_2$

D. None of these.

19. The 5th term of $(x + y)^{10}$ is:

A. ${}_{10}C_5\, x^5 y^5$

B. ${}_{10}C_6\, x^6 y^4$

C. ${}_{10}C_4\, x^6 y^4$

D. None of these.

20. The missing term in the following portion of Pascal's Triangle is ___________.

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 ? 1

A. ${}_5C_2$

B. ${}_5C_4$

C. ${}_5C_3$

D. None of these.

UNIT IX Permutations, Combinations, and Probability PART I

Test A B C D

NAME____________________________ SECTION____________

TEACHER__________________________ DATE______________

SCORE____________________________ PERIOD_____________

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________
11. ____________________
12. ____________________
13. ____________________
14. ____________________
15. ____________________
16. ____________________
17. ____________________
18. ____________________
19. ____________________
20. ____________________

UNIT IX

Permutations, Combinations, and Probability

PART II
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. An experiment consists of flipping two coins simultaneously. Which one of the following is a sample space for the experiment.

   A. $\{(h, t)\}$

   B. $\{(h, h), (h, t), (t, h), (t, t)\}$

   C. $\{(h, t), (t, h)\}$

   D. $\{(t, t), (h, h)\}$

2. In the same experiment as in Problem 1, what is the event that the outcome is two heads or two tails?

   A. $\{(h, t)\}$

   B. $\{(h, h), (h, t), (t, h), (t, t)\}$

   C. $\{(h, t), (t, h)\}$

   D. $\{(t, t), (h, h)\}$

3. In the same experiment as in Problem 1, what is the probability of two heads or two taiis?

   A. $\frac{1}{8}$

   B. $\frac{1}{4}$

   C. $\frac{1}{2}$

   D. 1

   E. 0

4. TRUE or FALSE: All probabilities are real numbers between 0 and $\frac{1}{2}$ inclusive.

5. A bag contains only 3 white marbles. What is the probability of drawing a white marble in one draw?

In Problems 6-8 the experiment consists of rolling a die once.

6. The probability of the outcome being a 3 is __________.

7. If the event is rolling a 3, the complementary event is:
   - A. Rolling a 6.
   - B. Rolling a number less than 6.
   - C. Rolling a number greater than 3.
   - D. Not rolling a 3.
   - E. None of these.

8. The odds that the event rolling a 3 will occur are:
   - A. 1 to 2
   - B. 1 to 3
   - C. 3 to 1
   - D. 2 to 3
   - E. None of these.

9. If A and B are mutually exclusive events and $P(A \cup B)$ is a probability that either A or B (or both) will occur, then $P(A \cup B) =$ __________.

In Problems 10-13, the experiment consists of drawing a card from a standard deck of 52 cards.

10. What is the probability that the card is ten?

11. What is the probability that the card is red?

12. What is the probability that the card is not a face card?

13. What is the probability that the card is a four of clubs?

In Problems 14-16, the experiment consists of drawing two marbles successively from an urn containing 4 red marbles and 6 blue marble.

14. If the first marble is returned to the urn before the second is drawn, what is the probability of drawing two blue marbles?

15. If the first marble is not returned before the second is drawn, what is the probability of drawing two blue marbles?

16. If the first marble is returned to the urn before the second is drawn, what is the probability of drawing a blue marble and then a red marble?

UNIT IX | Permutations, Combinations, and Probability | PART II
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. An experiment consists of flipping three coins simultaneously. Which one of the following is a sample space for the experiment?

   A. {(h, h, h), (h, t, h)}

   B. {(h, h), (h, t), (t, h), (t, t)}

   C. {(h, t, h), (t, h, h), (h, h, t)}

   D. {(h, h, h), (h, h, t), (h, t, h), (t, h, h), (t, t, h), (t, h, t), (h, t, t), (t, t, t)}

2. In the same experiment as in Problem 1, what is the event that the outcome is exactly two heads?

   A. {(h, h, t)}

   B. {(h, h, t), (h, t, h), (t, h, h)}

   C. {(h, h, t), (h, t, h)}

   D. {(t, h, h)}

3. In the same experiment as in Problem 1, what is the probability of exactly two heads occurring?

   A. $\frac{1}{2}$ D. $\frac{3}{8}$

   B. 1 E. $\frac{1}{4}$

   C. $\frac{5}{8}$

4. TRUE or FALSE: All probabilities are real numbers between 0 and 1 inclusive.

5. A bag contains only 3 white marbles. What is the probability of drawing a black marble in one draw?

In Problems 6-8 the experiment consists of rolling a die once.

6. The probability of the outcome being a 5 or a 6 is ______________.

7. If the event is rolling a 3, the complementary event is:

   A. Rolling a 5.

   B. Rolling a number less than 3.

   C. Rolling a number greater than 3.

   D. Rolling a 6.

   E. None of these.

8. The odds that the event rolling a three will occur are:

   A. 1 to 5

   B. 1 to 3

   C. 1 to 6

   D. 1 to 2

   E. None of these.

9. If A and B are mutually exclusive events and $P(A \cup B)$ is the probability that either A or B (or both) will occur, then $P(A \cup B) =$ ______________.

In Problems 10-13 the experiment consists of drawing a card from a standard deck of 52 cards.

10. What is the probability that the card is an ace?

11. What is the probability that the card is black?

12. What is the probability that the card is a face card?

13. What is the probability that the card is the queen of spades?

In Problems 14-16 the experiment consists of drawing two marbles successively from an urn containing 4 red marbles and 6 blue marbles.

14. If the first marble is returned to the urn before the second is drawn, what is the probability of drawing two red marbles?

15. If the first marble is not returned before the second is drawn, what is the probability of drawing two red marbles?

16. If the first marble is returned to the urn before the second is drawn, what is the probability of drawing a red marble and then a blue marble?

UNIT IX Permutations, Combinations, and Probability PART II
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. An experiment consists of flipping two coins simultaneously. Which one of the following is a sample space for the experiment?

   A. $\{(h, t)\}$

   B. $\{(h, t), (t, h)\}$

   C. $\{(h, h), (h, t), (t, h), (t, t)\}$

   D. $\{(h, t, t, h)\}$

2. In the same experiment as in Problem 1 what is the event that the outcome is two tails?

   A. $\{(h, t), (t, h)\}$

   B. $\{(t, t)\}$

   C. $\{(h, t), (h, h)\}$

   D. $\{(h, h)\}$

3. In the same experiment as in Problem 1 what is the probability of exactly two tails occurring?

   A. $\frac{1}{2}$ D. $\frac{3}{8}$

   B. $\frac{1}{4}$ E. $\frac{1}{6}$

   C. $\frac{1}{8}$

4. COMPLETION: All probabilities are real numbers between 0 and ____ inclusive.

5. A bag contains only 3 white marbles, what is the probability of drawing a red marble in one draw?

In Problems 6-8 the experiment consists of rolling a die once.

6. The probability of the outcome being a number less than 3 is __________.

7. If the event is rolling a number less than 3 then the complementary event is:

   A. Rolling a 5.

   B. Rolling a number greater than or equal to 3.

   C. Rolling a 3.

   D. Rolling a 1 or a 2.

   E. None of these.

8. The odds that the event rolling a number less than three will occur are:

   A. 1 to 1

   B. 1 to 3

   C. 1 to 2

   D. 1 to 5

   E. None of these.

9. If A and B are mutually exclusive events and $P(A \cup B)$ is the probability that either A or B (or both) will occur then $P(A \cup B) =$ ________________.

In Problems 10-13 the experiment consists of drawing a card from a standard deck of 52 cards.

10. What is the probability the card is a king?

11. What is the probability the card is an ace or a king?

12. What is the probability the card is not an ace or a deuce?

13. What is the probability the card is the jack of diamonds?

In Problems 14-16 the experiment consists of drawing two marbles successively from an urn containing 4 red and 6 blue marble.

14. If the first marble is returned to the urn before the second is drawn, what is the probability of drawing a red marble and then a blue marble?

15. If the first marble is not returned to the urn before the second is drawn, what is the probability of drawing a red marble and then a blue marble?

16. If the first marble is not returned to the urn before the second is drawn, what is the probability of drawing two red marbles?

UNIT IX Permutations, Combinations, and Probability PART II

Test A B C

NAME ____________________ SECTION ____________

TEACHER ____________________ DATE ____________

SCORE ____________________ PERIOD ____________

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

8. ____________________

9. ____________________

10. ____________________

11. ____________________

12. ____________________

13. ____________________

14. ____________________

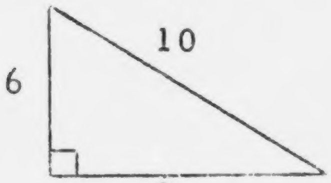
15. ____________________

16. ____________________

UNIT X **Quadratic Relations and Systems** PART I
Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Find the length of the unknown side of the right triangle given below.



a = ____________

In Problems 2 and 3, find the length of the line segment joining the points with given coordinates.

2. A (5, 3) ; B (-12, 3)

3. C (-2r, 3s) ; D (r, -3s)

4. Find the coordinates of the midpoint of the line segment joining the points with given coordinates:

$A\left(\frac{1}{2}, -1\right);\ B\left(\frac{1}{2}, 4\right)$

5. Find the coordinates of A if M is the midpoint of the line segment $\overline{AB}$.

M (-6, 2) ; B (-3, -1)

6. TRUE or FALSE: The following points are collinear: A (3, 7) ; B (-2, 2) ; C (-12, -8).

7. COMPLETION: A __________ is the set of all points equidistant from a given fixed point.

8. Write an equation in standard form of the circle with center C(4, -5) and radius 6.

9. Write the following equation in standard form:

$$y^2 + 6y + x^2 - 10x + 18 = 0$$

In Problems 10 through 12 refer to the relation $(x + 2)^2 + (y - 3)^2 = 9$.

10. Give the coordinates of the center of the circle.

11. Give the length of the radius of the circle.

12. Draw the graph of the relation on the coordinate axes provided.

13. Which of the following equations define a circle?

I. $y^2 + x^2 = 4$
II. $y - x^2 = 36$
III. $x^2 + 2y^2 = 9$
IV. $x^2 + y^2 = 16$
V. $2x + y = 49$

A. Only I, IV.
B. Only I, III, IV.
C. Only II, V.
D. All of the equations.
E. None of the equations.

14. Graph the relation: $(x + 2)^2 + (y - 3)^2 \leq 9$

15. Write the relation $y = x^2 + 2x - 2$ into standard form.

In Problems 16 through 20 refer to the relation $y = -(x - 3)^2 + 4$.

16. Write the equation of the axis of symmetry.

17. Write the coordinates of the vertex.

18. State the direction of concavity.

19. Is the vertex a maximum point? Answer "Yes" or "No".

20. Draw the graph of this relation on the coordinate axes provided on the answer sheet.

21. Determine the equation of the parabola with focus P(0, 5) and directrix $y = -5$.

22. Which of the following equations define a parabola?

I. $y^2 = x^2 + 5$
II. $y = 2x - 6$
III. $y = 9(x - 1)^2 + 7$
IV. $y = 4x + 5$
V. $y = 2x^2 - 3$

A. Only I.
B. Only I, III, V.
C. Only III, V.
D. All of the equations.
E. None of the equations.

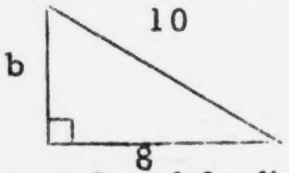
UNIT X

Quadratic Relations and Systems

PART I
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Find the length of the unknown side of the triangle given below.



b = ___________

In Problems 2 and 3, find the length of the line segment joining the points with given coordinates.

2. A(1, 2) ; B(7, 10)

3. C(2x, y) ; D(5x, 5y)

4. Find the coordinates of the midpoint of the line segment joining the points with given coordinates:

   A(3, -1) ; B(4, -3)

5. Find the coordinates of A if M is the midpoint of the line segment $\overline{AB}$.

   M(5, 4) ; B(6, 2)

6. TRUE or FALSE: The following points are collinear: R(1, 1); S(-2, -5) ; T(0, 1).

7. COMPLETION: A ___________ is the set of all points equidistant from a given fixed point.

8. Write an equation in standard form of the circle with center (-2, 3) and radius 4.

9. Write the following equation in standard form:

$$x^2 + 16x + y^2 - 6y + 69 = 0$$

In Problems 10 through 12 refer to the relation $(x - 4)^2 + (y + 3)^2 = 9$.

10. Write the coordinates of the center.

11. Write the length of the radius.

12. Draw the graph of the relation on the coordinate axes provided on the answer sheet.

13. Which of the following equations define a circle?

I.	$y - x^2 = 36$	IV.	$x^2 + 2y^2 = 9$
II.	$x^2 + y^2 = 16$	V.	$2x + y = 49$
III.	$y^2 + x^2 = 4$		

A.	Only I, II, III.	D.	All of the equations.
B.	Only II, III.	E.	None of the equations.
C.	Only II, III, IV.		

14. Draw the graph of the relation $(x - 1)^2 + (y + 2)^2 \geq 9$ on the coordinate axes provided on the answer sheet.

15. Write the relation $y = x^2 - 4x - 1$ in standard form.

In Problems 16 through 20, refer to the relation $y = \frac{1}{2}(x - 2)^2 - 4$.

16. Write the equation of the axis of symmetry.

17. Write the coordinates of the vertex.

18. State the direction of concavity.

19. Is the vertex a maximum point? Answer "Yes" or "No".

20. Draw the graph of this relation on the coordinate axes provided on the answer sheet.

21. Determine the equation of the parabola with focus (0, 3) and directrix $y = 1$.

22. Which of the following equations define a parabola?

I.	$y = 2x - 6$	IV.	$y = 3x^2 + 2$
II.	$y = 4x + 5$	V.	$y = -\frac{1}{2}(x + 3)^2 - 4$
III	$y^2 = x^2 + 5$		

A.	Only V.	D.	All of the equations.
B.	Only IV, V.	E.	None of the equations.
C.	Only III, IV, V.		

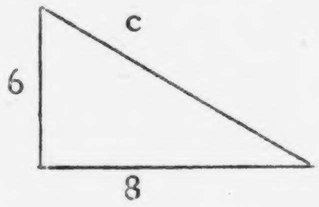
UNIT X

Quadratic Relations and Systems

PART I
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. Find the length of the unknown side of the right triangle given below.



c = ____________

In Problems 2 and 3, find the length of the line segment joining the points with given coordinates.

2. A(2, 3) ; B(-3, 5)

3. C(5a, 3b) ; D(-12a, 3b) where $a > 0$ and $b > 0$.

4. Find the coordinates of the midpoint of the line segment joining the points with given coordinates:

   A(-2, 3) ; B(1, -3)

5. Find the coordinates of A if M is the midpoint of the line segment $\overline{AB}$.

   $M(\frac{1}{2}, \frac{3}{2})$; $B(\frac{1}{2}, -1)$

6. TRUE or FALSE: The following points are collinear: A(-2, -8); B(0, -2); C(4, 10).

7. COMPLETION: A ____________ is the set of all points equidistant from a given fixed point.

8. Write an equation in standard form of the circle with center C(3, -2) and radius 2.

9. Write the following equation in standard form:

$$x^2 + 6x + y^2 - 8y - 11 = 0$$

In Problems 10 through 12, refer to the relation $(x - 1)^2 + (y + 2)^2 = 9$.

10. Give the coordinates of the center of the circle.

11. Give the length of the radius of the circle.

12. Draw the graph of the relation on the coordinate axes provided.

13. Which of the following equations define a circle?

I. $y^2 + x^2 = 16$

II. $x^2 + y^2 = 1$

III. $x^2 - y^2 = 49$

IV. $3x - 4 = y$

V. $2x^2 + 3y^2 = 9$

A. Only I and II.

B. Only I, II and V.

C. Only III.

D. All of the equations.

E. None of the equations.

14. Graph the relation $(x - 1)^2 + (y + 3)^2 < 9$.

15. Write the relation $y = x^2 + 8x - 2$ in standard form.

In Problems 16 through 20, refer to the relation $y = 2(x - 2)^2 - 1$.

16. Write the equation of the axis of symmetry.

17. Write the coordinates of the vertex.

18. State the direction of concavity.

19. Is the vertex a maximum point? Answer "Yes" or "No".

20. Draw the graph of this relation on the coordinate axes provided on the answer sheet.

21. Determine the equation of the parabola with focus $P(5, 0)$ and directrix $x = -5$.

22. Which of the following equations define a parabola?

I. $y = 3x^2 - 5$

II. $y^2 = 3x^2 - 5$

III. $y = 4(x - 3)^2 + 1$

IV. $y = 3x - 5$

V. $y^2 + x^2 = 4$

A. Only I.

B. Only I and III.

C. Only I, III and V.

D. All of the equations.

E. None of the equations.

UNIT X

Quadratic Relations and Systems

PART I
Test A B C

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Quadratic Relations and Systems

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1 through 3 refer to the relation: $\frac{x^2}{4} + \frac{y^2}{16} = 1$

1. Write the x-intercepts.

2. Write the y-intercepts.

3. Sketch the ellipse on the coordinate axes provided on the answer sheet.

4. Write $\frac{x^2}{25} + \frac{y^2}{4} = 1$ in general form.

5. Write $4x^2 + y^2 = 100$ in standard form.

6. Write the equation of the ellipse whose foci have coordinates $(0, 4)$; $(0, -4)$ and the sum of whose focal radii is 12.

7. Which of the following are equations of an ellipse?

   I. $y = x^2 - 3x + 4$

   II. $\frac{x^2}{4} + \frac{y^2}{25} = 1$

   III. $49x^2 - 100y^2 = 4900$

   IV. $\frac{x^2}{4} - \frac{y^2}{25} = 1$

   V. $49x^2 + 100y^2 = 4900$

   A. Only II, III, IV, V.

   B Only II, III, V.

   C. Only II, V.

   D. All of the equations.

   E. None of the equations.

8. Draw the graph of $\{(x, y) \mid \frac{x^2}{4} + \frac{y^2}{16} \geq 1\}$ on the coordinate axes provided in the answer sheet.

9. Draw the graph of the hyperbola given below by constructing the basic rectangle, the asymptotes, and plotting several points on the coordinate axes provided on the answer sheet.

   $$\frac{y^2}{4} - \frac{x^2}{9} = 1$$

10. Write the equation of the hyperbola $49y^2 - 4x^2 = 196$ in standard form.

11. Which of the following are equations of a hyperbola?

I. $y = x^2 - 4x + 3$

II. $y^2 - \frac{x^2}{9} = 1$

III. $y^2 + \frac{x^2}{9} = 1$

IV. $100y^2 - 36x^2 = 3600$

V. $\frac{x^2}{16} - \frac{y^2}{4} = 1$

A. Only II, IV, V.

B. Only I, II, IV, V.

C. Only III.

D. All of the equations.

E. None of the equations.

12. COMPLETION: The circle, parabola, ellipse and hyperbola are examples of ______________ sections.

In Problems 13 and 14, find the solution sets of the given systems of equations.

13. $y = x$

$x^2 + y^2 = 2$

14. $x^2 + y^2 = 13$

$y = x^2 - 7$

UNIT X

Quadratic Relations and Systems

PART II
Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1 through 3, refer to the relation: $\frac{x^2}{36} + \frac{y^2}{25} = 1$

1. Write the x-intercepts.

2. Write the y-intercepts.

3. Sketch the ellipse on the coordinate axes provided on the answer sheet.

4. Write $\frac{x^2}{16} + \frac{y^2}{9} = 1$ in general form.

5. Write $9x^2 + 25y^2 = 225$ in standard form.

6. Write the equation of the ellipse whose foci have coordinates $(0, -5)$, $(0, 5)$ and the sum of whose focal radii is 14.

7. Which of the following are equations of ellipses?

I. $\frac{x^2}{16} + \frac{y^2}{25} = 1$

II. $\frac{x^2}{9} + \frac{y}{100} = 1$

III. $\frac{x^2}{25} - \frac{y^2}{36} = 1$

IV. $20x^2 + 16y^2 = 100$

V. $x^2 + y^2 = 36$

A. Only I, IV, V.

B. Only I, III.

C. Only I, V.

D. All of the equations.

E. None of the equations.

8. Draw the graph of $\{(x, y) \mid \frac{x^2}{4} + \frac{y^2}{36} < 1\}$ on the coordinate axes provided on the answer sheet.

9. Draw the graph of the hyperbola given below by constructing the basic rectangle, asymptotes and plotting several points on the coordinate axes provided on the answer sheet.

$$\frac{x^2}{9} - \frac{y^2}{16} = 1$$

10. Write the equation of the hyperbola $36x^2 - 25y^2 = 900$ in standard form.

11. Which of the following are equations of hyperbolas?

I. $\frac{y^2}{4} - x^2 = 1$

II. $16y^2 - 25x^2 = 400$

III. $\frac{x^2}{16} - \frac{y}{25} = 1$

IV. $\frac{y^2}{25} - \frac{x^2}{81} = 1$

V. $\frac{x^2}{9} + \frac{y^2}{100} = 1$

A. Only III, IV.

B. Only I, II, III, IV.

C. Only I, II, IV.

D. All of the equations.

E. None of the equations.

12. COMPLETION: The circle, parabola, ellipse and hyperbola are examples of __________________ sections.

In Problems 13 and 14, find the solution sets of the given systems of equations.

13. $y = x$

$x^2 + y^2 = 32$

14. $x^2 - y^2 = 9$

$x^2 + 9y^2 = 169$

UNIT X

Quadratic Relations and Systems

PART II
Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

In Problems 1-3 refer to the relation: $\frac{x^2}{9} + \frac{y^2}{25} = 1$

1. Write the x-intercepts.

2. Write the y-intercepts.

3. Sketch the ellipse on the coordinate axes provided on the answer sheet.

4. Write $\frac{x^2}{4} + \frac{y^2}{16} = 1$ in general form.

5. Write $4x^2 + y^2 = 100$ in standard form.

6. Write the equation of the ellipse whose foci have coordinates (0, 4); (0, -4) and the sum of whose focal radii is 12.

7. Which of the following are equations of an ellipse?

I. $\frac{x^2}{9} + \frac{y^2}{25} = 1$

II. $\frac{x}{9} + \frac{y}{144} = 1$

III. $\frac{x^2}{25} - \frac{y^2}{49} = 1$

IV. $9x^2 + 16y^2 - 144 = 0$

V. $x^2 + y^2 = 36$

A. Only I, III, V.

B. Only I, IV, V.

C. Only III, V.

D. All of the equations.

E. None of the equations.

8. Draw the graph of $\{(x, y) \mid \frac{x^2}{16} + \frac{y^2}{25} > 1\}$

9. Draw the graph of the hyperbola given below by constructing the basic rectangle, asymptotes and plotting several points on the coordinate axes provided on the answer sheet.

$$\frac{y^2}{16} - \frac{x^2}{9} = 1$$

10. Write the equation of the hyperbola $36x^2 - 16y^2 = 576$ in standard form.

11. Which of the following are equations of a hyperbola?

I. $\frac{x^2}{16} - \frac{y}{25} = 1$

II. $\frac{x^2}{9} + \frac{y^2}{100} = 1$

III. $\frac{y^2}{4} - x^2 = 1$

IV. $\frac{y^2}{25} - \frac{x^2}{81} = 1$

V. $16x^2 - 25y^2 = 400$

A. Only III and IV.

B. Only III, IV and V.

C. Only I, II.

D. All of the above equations.

E. None of the equations.

12. COMPLETION: The circle, parabola, ellipse and hyperbola are examples of ______________ sections.

In Problems 13 and 14, find the solution sets of the given system of equations.

13. $y = x$

$x^2 + y^2 = 32$

14. $x^2 + y^2 = 13$

$y = x^2 - 7$

UNIT X — Quadratic Relations and Systems — PART II
Test A B C

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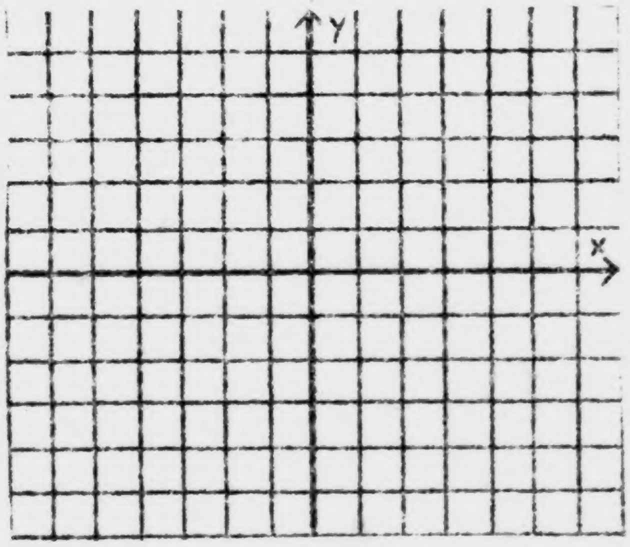

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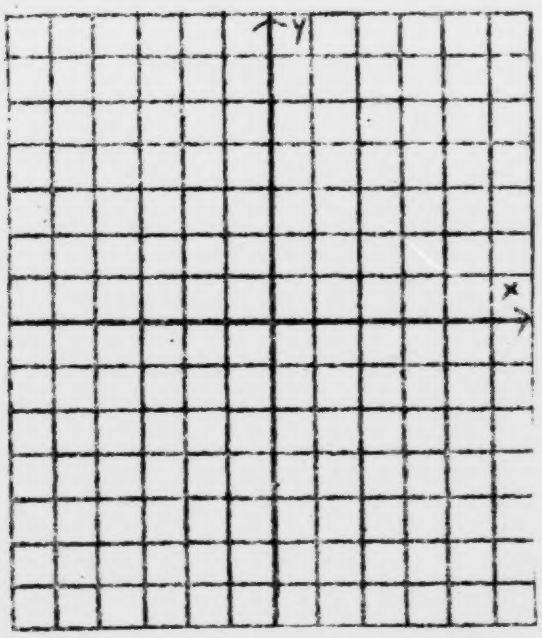

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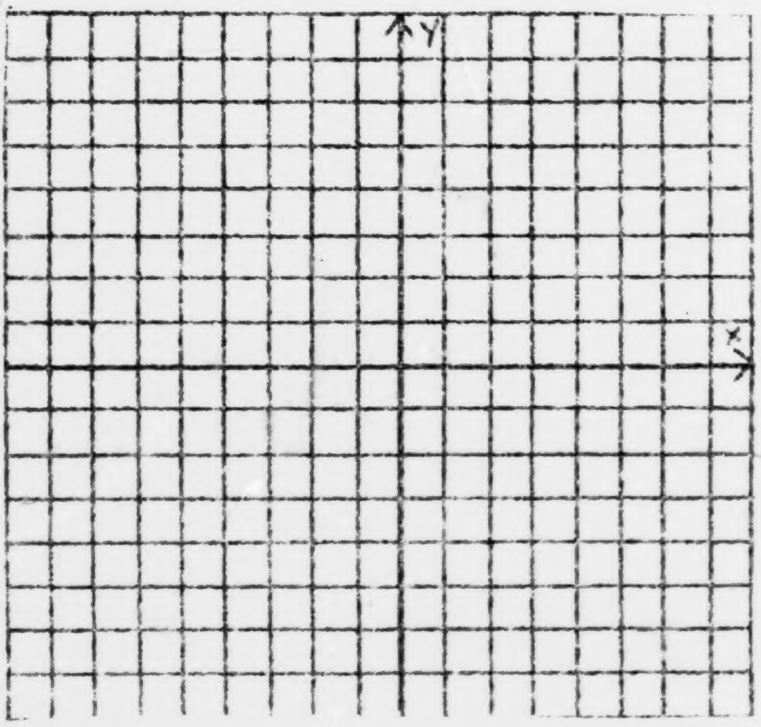

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UNIT XI

Matrices and Determinants

Test A

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. COMPLETION: A ___________ is a rectangular array of numbers.

In Problems 2 through 5, refer to the following matrix.

$$\begin{bmatrix} 3 & 4 \\ -1 & 0 \\ 5 & 7 \end{bmatrix}$$

2. Write the dimensions of the matrix.

3. Write the elements of the 2nd row.

4. Write the element found in the second row, first column.

5. Write the transpose of the matrix.

6. Write the zero matrix with dimensions 3×1.

In Problems 7 through 10, perform the indicated operations.

7. $$\begin{bmatrix} 2 & 1 \\ 4 & 3 \\ 1 & -5 \end{bmatrix} + \begin{bmatrix} 0 & -2 \\ 3 & 4 \\ -7 & 5 \end{bmatrix}$$

8. $$5 \begin{bmatrix} 3 & -1 \\ 0 & 4 \end{bmatrix}.$$

9. $$-3 \begin{bmatrix} 2 & 1 & 4 \\ 0 & 1 & -1 \end{bmatrix} + 2 \begin{bmatrix} 4 & -1 & 6 \\ 3 & 0 & -2 \end{bmatrix}$$

10. $$\begin{bmatrix} 5 & 1 & 6 \\ 3 & -1 & -2 \end{bmatrix} - \begin{bmatrix} 0 & 2 & -4 \\ -3 & 1 & 2 \end{bmatrix}$$

11. Write the additive inverse of the following matrix:

$$\begin{bmatrix} -2 & 3 \\ 1 & -4 \\ 0 & 1 \end{bmatrix}$$

12. Which of the following are properties of matrix addition for the set of 2 x 2 matrices? Write the letter of the correct answer on your answer sheet.

I. The closure property.
II. The commutative property.
III. The associative property.

A. I only.
B. I and II only.
C. I and III only.
D. II only.
E. I, II, and III.

In Problems 13 and 14, solve for the variable matrix x in each equation.

13. $$X + \begin{bmatrix} 3 & 1 \\ 2 & 4 \\ -1 & 3 \end{bmatrix} = \begin{bmatrix} 3 & -1 \\ 4 & 1 \\ -2 & 0 \end{bmatrix}$$

14. $$X + \begin{bmatrix} 1 & 2 & -4 \\ 3 & 1 & -4 \end{bmatrix} = \begin{bmatrix} 5 & 4 & 6 \\ 1 & -3 & 2 \end{bmatrix}$$

15. TRUE or FALSE: $\begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} \cdot \begin{bmatrix} 2 & 1 & 5 \\ -1 & 0 & 6 \end{bmatrix}$ is a 2 x 3 matrix.

In Problems 16 and 17 find the product of the given matrices.

16. $A = \begin{bmatrix} 2 & 1 \\ 3 & -1 \end{bmatrix}$; find A^2

17. $$\begin{bmatrix} 2 & 1 & 4 \\ 3 & 2 & 1 \\ -1 & 2 & -2 \end{bmatrix} \cdot \begin{bmatrix} 3 & 4 \\ 1 & 2 \\ 0 & -5 \end{bmatrix}$$

18. Write the identity matrix for multiplication for a 3 x 3 matrix.

19. Which of the following properties does not hold in the set of 2 x 2 matrices. Write the letter(s) of the correct answer(s) on the answer sheet.

A. Commutative property of multiplication.
B. Associative property of multiplication.
C. Distributive property of multiplication over addition.

20. Write the minor of the element 2 in the following determinant:

$$\begin{vmatrix} 1 & 3 & 2 \\ -1 & 0 & 6 \\ 1 & 7 & 5 \end{vmatrix}$$

21. TRUE or FALSE: $1\begin{vmatrix} 0 & 6 \\ 7 & 5 \end{vmatrix} + 3\begin{vmatrix} -1 & 6 \\ 1 & 5 \end{vmatrix} + 2\begin{vmatrix} -1 & 0 \\ 1 & 7 \end{vmatrix}$ is the expansion by minors of row 1 for the matrix:

$$\begin{bmatrix} 1 & 3 & 2 \\ -1 & 0 & 6 \\ 1 & 7 & 5 \end{bmatrix}$$

22. Compute the determinant of the following matrix:

$$\begin{bmatrix} 5 & -1 & 2 \\ 3 & 0 & 1 \\ 4 & 2 & 7 \end{bmatrix}$$

23. COMPLETION: The product of a matrix and its ________________ is the multiplicative identity.

24. TRUE or FALSE: If $A = \begin{bmatrix} 2 & 1 \\ 4 & 5 \end{bmatrix}$, $B = \begin{bmatrix} -2 & 3 \\ 1 & -5 \end{bmatrix}$ then A is the multiplicative inverse of B.

25. COMPLETION: Matrix A has a multiplicative inverse if and only if its ________________ is not zero.

26. Write the multiplicative inverse of:

$$\begin{bmatrix} 2 & 3 \\ -1 & 4 \end{bmatrix}$$

27. Solve the equation for the variable matrix A.

$$\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix} \cdot A = \begin{bmatrix} 8 & 9 \\ 9 & 12 \end{bmatrix}$$

Problems 28 and 29 refer to the system of linear equations:

$$3x + y = 1$$

$$x - 2y = -2$$

28. Write the corresponding matrix equation.

29. Solve the matrix equation in Problem 28.

UNIT XI

Matrices and Determinants

Test B

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. COMPLETION: A ____________ is a rectangular array of numbers.

In Problems 2 through 5, refer to the following matrix:

$$\begin{bmatrix} 2 & 4 & 7 \\ -3 & 0 & 1 \end{bmatrix}$$

2. Write the dimensions of the matrix.

3. Write the elements in the second column.

4. Write the element in the second row and the first column.

5. Write the transpose of the matrix.

6. Write the zero matrix with dimensions 1 x 3.

In Problems 7 through 10, perform the indicated operations.

7. $$\begin{bmatrix} -2 & 4 & -6 \\ 3 & 1 & 0 \end{bmatrix} + \begin{bmatrix} 0 & -3 & -2 \\ 4 & -6 & 5 \end{bmatrix}$$

8. $$-5 \begin{bmatrix} 2 & 1 & -5 \\ 1 & 3 & 0 \\ -7 & 0 & -4 \end{bmatrix}$$

9. $$3 \begin{bmatrix} -2 & 1 \\ -3 & 4 \end{bmatrix} - 1 \begin{bmatrix} -1 & -3 \\ 1 & -2 \end{bmatrix}$$

10. $$\begin{bmatrix} 2 & 1 \\ 0 & 2 \end{bmatrix} - \begin{bmatrix} -2 & 1 \\ 3 & 4 \end{bmatrix}$$

11. Write the additive inverse of the following matrix:

$$\begin{bmatrix} -2 & -6 \\ 5 & 0 \end{bmatrix}$$

12. Which of the following are properties of matrix addition for the set of 2 x 2 matrices? Write the letter of the correct answer on your answer sheet.

I. The closure property.
II. The commutative property.
III. The associative property.

A. I, II, and III.
B. I and II only.
C. I and III only.
D. III only.
E. I only.

In Problems 13 and 14, solve for the variable matrix in each equation.

13. $X + \begin{bmatrix} 5 & 2 \\ -3 & 1 \end{bmatrix} = \begin{bmatrix} -2 & 3 \\ -4 & 0 \end{bmatrix}$

14. $2 \cdot X + \begin{bmatrix} -1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 2 \\ -1 & 3 & 1 \\ 1 & 0 & 0 \end{bmatrix}$

15. TRUE or FALSE: $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ is a 2 x 3 matrix.

In Problems 16 and 17, find the product of the given matrices.

16. $X = \begin{bmatrix} 3 & 0 \\ -1 & 2 \end{bmatrix}$: find x^2.

17. $\begin{bmatrix} -2 & 1 & 0 \\ 0 & 1 & 1 \\ -1 & 2 & 1 \end{bmatrix} \begin{bmatrix} -3 & 0 & 1 \\ 1 & 2 & -1 \\ -1 & 1 & 3 \end{bmatrix}$

18. Write the identity matrix for multiplication for a 2 x 2 matrix.

19. Which of the following properties does not hold in the set of 2 x 2 matrices? Write the letter(s) of the correct answer on your answer sheet.

A. Commutative property of multiplication.
B. Associative property of multiplication.
C. Distributive property of multiplication over addition.

20. Write the minor of the element 3 in the following determinant:

$$\begin{vmatrix} 2 & -1 & 4 \\ 0 & 3 & 5 \\ -2 & 0 & 1 \end{vmatrix}$$

21. TRUE or FALSE: $1\begin{vmatrix} 1 & -2 \\ -1 & 2 \end{vmatrix} - 1\begin{vmatrix} 3 & -2 \\ 2 & 2 \end{vmatrix} + 0\begin{vmatrix} 3 & 1 \\ 2 & -1 \end{vmatrix}$ is the expansion by minors of row 3 for the matrix:

$$\begin{bmatrix} 3 & 1 & -2 \\ 2 & -1 & 2 \\ 1 & 1 & 0 \end{bmatrix}$$

22. Compute the determinant for the following matrix:

$$\begin{bmatrix} 1 & 0 & 2 \\ -1 & 1 & 0 \\ 2 & -1 & 3 \end{bmatrix}$$

23. COMPLETION: The product of a matrix and its ________________ is the multiplicative identity.

24. TRUE or FALSE: If $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} \frac{3}{5} & -\frac{2}{5} \\ \frac{1}{5} & \frac{1}{5} \end{bmatrix}$ then B is the multiplicative inverse of A.

25. COMPLETION: Matrix A has a multiplicative inverse if and only if its ________________ is not zero.

26. Write the multiplicative inverse of:

$$\begin{bmatrix} 4 & 5 \\ 0 & 1 \end{bmatrix}$$

27. Solve the equation for the variable matrix:

$$\begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix} A = \begin{bmatrix} 3 & -2 \\ 2 & 2 \end{bmatrix}$$

In Problems 28 and 29, refer to the system of linear equations:

$$5x - 2y = 1$$

$$2x - y = 0$$

28. Write the corresponding matrix equation.

29. Solve the matrix equation written in Problem 28.

UNIT XI

Matrices and Determinants

Test C

DIRECTIONS: Do not write on this test paper. Do all scratch work on the paper provided for this purpose. Place all answers on the answer sheet. Do not spend too much time on any one problem.

1. COMPLETION: A ____________ is a rectangular array of numbers.

In Problems 2 through 5, refer to the following matrix:

$$\begin{bmatrix} 1 & -1 & 2 \\ 4 & 6 & 3 \\ -2 & 1 & 0 \\ 5 & 3 & -7 \end{bmatrix}$$

2. Write the dimensions of the matrix.

3. Write the elements of the second row.

4. Write the element in the third row, first column.

5. Write the transpose of the matrix.

6. Write the zero matrix with dimensions 2 x 3.

In Problems 7-10 perform the indicated operations.

7. $\begin{bmatrix} 1 & 6 \\ -2 & 3 \end{bmatrix} + \begin{bmatrix} 5 & 4 \\ -8 & 10 \end{bmatrix}$

8. $-4 \cdot \begin{bmatrix} 3 & 5 \\ -5 & 0 \\ 1 & -4 \end{bmatrix}$

9. $5 \begin{bmatrix} -2 & 4 & 7 \\ 3 & -1 & -1 \end{bmatrix} + 3 \begin{bmatrix} 1 & -4 & 5 \\ 3 & -8 & 7 \end{bmatrix}$

10. $\begin{bmatrix} 1 & -4 \\ 5 & -3 \end{bmatrix} - \begin{bmatrix} 6 & 7 \\ 10 & -9 \end{bmatrix}$

11. Write the additive inverse of the following matrix:

$$\begin{bmatrix} 5 & -2 & 0 \\ 1 & 3 & -6 \\ 7 & 12 & -4 \end{bmatrix}$$

12. Which of the following are properties of matrix addition for the set of 2×2 matrices? Write the letter of the correct answer on your answer sheet.

I. The closure property.
II. The commutative property.
III. The associative property.

A. I only.
B. I and III only.
C. I, II and III.
D. II only.
E. II and III only.

In Problems 13 and 14 solve for the variable matrix in each equation.

13. $X + \begin{bmatrix} 2 & 1 \\ 0 & -1 \\ 6 & -5 \end{bmatrix} = \begin{bmatrix} 4 & 1 \\ -5 & -11 \\ -3 & 0 \end{bmatrix}$

14. $2 \cdot X + \begin{bmatrix} 5 & -2 \\ -3 & 1 \end{bmatrix} = \begin{bmatrix} 4 & -7 \\ 6 & 8 \end{bmatrix}$

15. TRUE or FALSE: $\begin{bmatrix} 2 & 1 & 6 \\ -5 & 3 & -1 \end{bmatrix} \cdot \begin{bmatrix} 6 & 7 \\ -1 & 1 \\ 5 & 4 \end{bmatrix}$ is a 2×2 matrix.

In Problems 16 and 17 find the product of the given matrices.

16. $A = \begin{bmatrix} 4 & 5 \\ -1 & -2 \end{bmatrix}$; find A^2.

17. $\begin{bmatrix} 1 & 3 & 10 \\ 2 & -2 & -6 \\ -4 & 5 & 3 \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 2 \\ -5 \end{bmatrix}$

18. Write the identity matrix for multiplication for a 4×4 matrix.

19. Which of the following properties does not hold in the set of 2×2 matrices. Write the letter(s) of the correct answer(s) on the answer sheet.

A. Associative property of multiplication.
B. Commutative property of multiplication.
C. Commutative property of addition.

20. Write the minor of the element 3 in the following determinant:

$$\begin{vmatrix} 4 & 3 & 6 \\ 2 & -1 & -5 \\ 5 & 7 & -3 \end{vmatrix}$$

21. TRUE or FALSE: $5 \cdot \begin{vmatrix} -2 & -7 \\ 5 & 9 \end{vmatrix} - 4 \cdot \begin{vmatrix} 1 & -6 \\ 5 & 9 \end{vmatrix} + 3 \cdot \begin{vmatrix} 1 & -6 \\ -2 & -7 \end{vmatrix}$ is the expansion by minors of column 2 of the following matrix:

$$\begin{vmatrix} 1 & 5 & -6 \\ -2 & 4 & -7 \\ 5 & 3 & 9 \end{vmatrix}$$

22. Compute the determinant of the following matrix:

$$\begin{bmatrix} 4 & -5 & 2 \\ 3 & 4 & -2 \\ 4 & -5 & 1 \end{bmatrix}$$

23. COMPLETION: The product of a matrix and its inverse is the multiplicative ________________.

24. TRUE or FALSE: If $A = \begin{bmatrix} 1 & 4 \\ 3 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & -4 \\ -3 & 1 \end{bmatrix}$ then A is the multiplicative inverse of B.

25. COMPLETION: Matrix A has a multiplicative inverse if and only if its determinant is not ________________.

26. Write the multiplicative inverse of:

$$\begin{bmatrix} 6 & -5 \\ -2 & 3 \end{bmatrix}$$

27. Solve the equation for the variable matrix X.

$$\begin{bmatrix} 5 & 2 \\ 1 & -4 \end{bmatrix} \cdot X = \begin{bmatrix} 2 & 3 \\ -1 & -10 \end{bmatrix}$$

Problems 28 and 29 refer to the system of linear equations:

$3x - 2y = 4$

$x + 5y = 6$

28. Write the corresponding matrix equation.

29. Solve the matrix equation in 28.

UNIT XI **Matrices and Determinants** Test A B C D

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TEACHER ____________________ DATE __________

SCORE ____________________ PERIOD __________

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APPENDIX C

ANSWER KEYS AND CHECK LISTS

FOR

A SELF-PACING PROGRAM IN ALGEBRA

VOLUME II

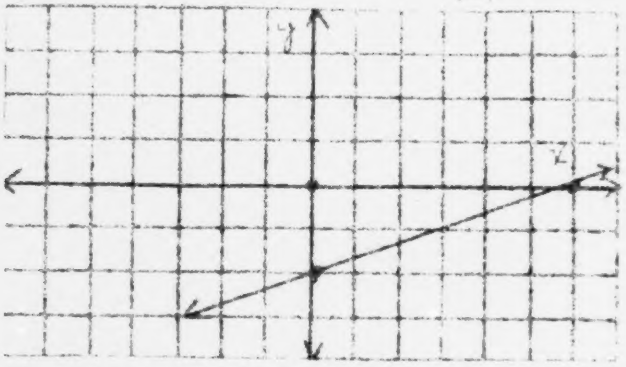
Acceptable Score $\frac{30}{38}$

UNIT I

TEACHER'S ANSWER KEY

PART I
Test A

SECOND YEAR ALGEBRA

1.	(5,6)	(2)
2.	(-5,-2)	(2)
3.	(0,5)	(2)
4.	II	(2)
5.	IV	(2)
6.	-2	(2)
7.	0	(2)
8.	F	(2)
9.	L	(2)
10.	J, L, K or O	(2)
11.	Yes	(2)
12.	Yes	(2)
13.	No	(2)
14.	No	(2)
15.	Yes	(1)
16.	No	(1)
17.	Yes	(1)
18.	-1	(1)
19.	4	(1)
20.		(2)
21.	$y = 2x - 7$	(2)
22.	$y = \frac{1}{3}x - 3$	(2)
23.	2	(2)
24.	1	(2)
25.	$-\frac{1}{2}$	(3)
26.	1	(3)
27.	-1	(3)
28.	E	(4)
29.	J	(2)
30.	C	(4)
31.	H	(4)
32.	K	(4)
33.	1	(2)

34.	F	(2)
35.	G	(2)
36.	$2x - y - 3 = 0$	(4)
37.	$4x - y - 7 = 0$	(4)
38.	$2x - y + 16 = 0$	(4)

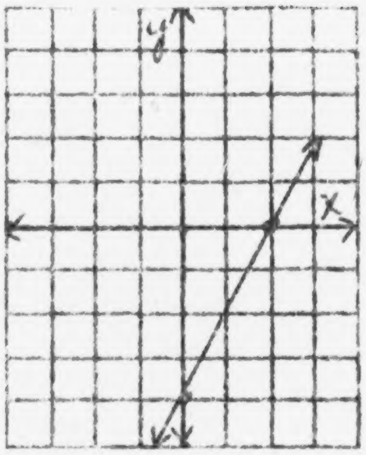
Acceptable Score $\frac{30}{38}$

UNIT I

TEACHER'S ANSWER KEY

PART I
Test B

SECOND YEAR ALGEBRA

1.	(-6, -6)	(2)
2.	(5, 3)	(2)
3.	(0, 5)	(2)
4.	II	(2)
5.	IV	(2)
6.	-2	(2)
7.	-4	(2)
8.	C	(2)
9.	D	(2)
10.	I, O, D	(2)
11.	Yes	(2)
12.	No	(2)
13.	No	(2)
14.	Yes	(2)
15.	No	(1)
16.	Yes	(1)
17.	Yes	(1)
18.	0	(1)
19.	$\frac{5}{3}$	(1)
20.		(2)
21.	$y = 3x - 10$	(2)
22.	$y = 2x - 6$	(2)
23.	-2	(2)
24.	-3	(2)
25.	-2	(3)
26.	$\frac{1}{3}$	(3)
27.	3	(3)
28.	E	(4)
29.	J	(2)
30.	C	(4)
31.	H	(4)
32.	K	(4)

33. I (2)

34. F (2)

35. G (2)

36. $\frac{1}{2}x - y + 5 = 0$ or

$x - 2y + 10 = 0$ (4)

37. $3x - y + 5 = 0$ (4)

38. $x - y - 1 = 0$ (4)

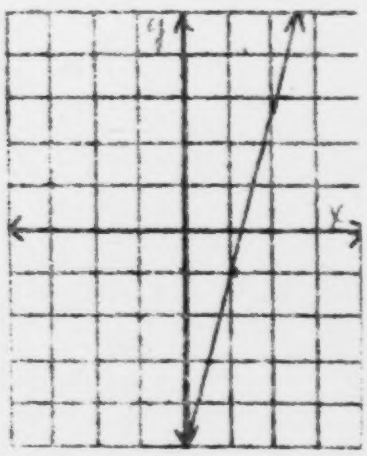
Acceptable Score $\frac{30}{38}$

UNIT I

TEACHER'S ANSWER KEY

PART I
Test C

SECOND YEAR ALGEBRA

1.	(-3, 0)	(2)
2.	(-3, 5)	(2)
3.	(-5, -3)	(2)
4.	IV	(2)
5.	III	(2)
6.	-4	(2)
7.	0	(2)
8.	I	(2)
9.	G	(2)
10.	J	(2)
11.	Yes	(2)
12.	No	(2)
13.	Yes	(2)
14.	No	(2)
15.	No	(1)
16.	Yes	(1)
17.	No	(1)
18.	-2	(1)
19.	-1	(1)
20.		(2)
21.	$y = -x + 3$	(2)
22.	$y = \frac{4}{3}x - \frac{5}{3}$	(2)
23.	-2	(2)
24.	-3	(2)
25.	2	(3)
26.	$-\frac{2}{3}$	(3)
27.	I	(3)
28.	E	(4)
29.	J	(2)
30.	C	(4)
31.	H	(4)
32.	K	(4)
33.	I	(2)
34.	F	(2)
35.	G	(2)
36.	$x + y - 5 = 0$	(4)
37.	$2x - 3y + 8 = 0$	(4)
38.	$7x + 5y - 11 = 0$	(4)

Acceptable Score $\frac{30}{38}$

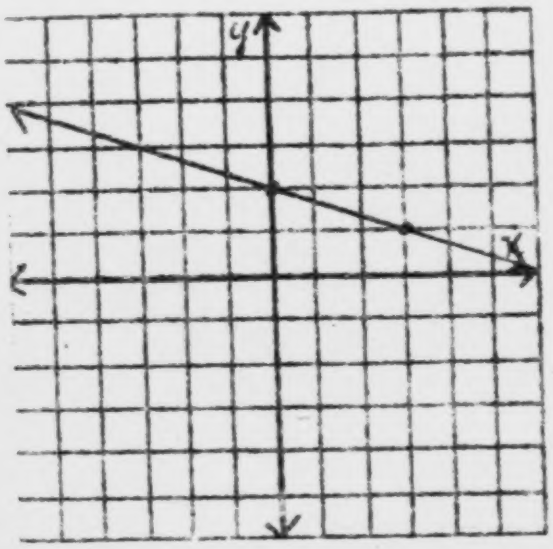
UNIT I

TEACHER'S ANSWER KEY

PART I
Test D

SECOND YEAR ALGEBRA

1.	(-2, 0)	(2)
2.	(-1, -2)	(2)
3.	(-4, -3)	(2)
4.	IV	(2)
5.	I	(2)
6.	-2	(2)
7.	1	(2)
8.	A	(2)
9.	E	(2)
10.	B and I	(2)
11.	No	(2)
12.	Yes	(2)
13.	No	(2)
14.	Yes	(2)
15.	No	(1)
16.	Yes	(1)
17.	Yes	(1)
18.	2	(1)
19.	-5	(1)
20.		(2)



21.	$y = 3x - 6$	(2)
22.	$y = \frac{1}{3}x - \frac{7}{3}$	(2)
23.	-2	(2)
24.	2	(2)
25.	1	(3)
26.	$-\frac{1}{2}$	(3)
27.	$-\frac{4}{3}$	(3)
28.	G	(4)
29.	I	(2)
30.	J	(4)
31.	C	(4)
32.	E	(4)
33.	H	(2)
34.	K	(2)
35.	F	(2)
36.	$3x - y - 2 = 0$	(4)
37.	$5x - y - 10 = 0$	(4)
38.	$2x - y + 15 = 0$	(4)

Acceptable Score $\frac{9}{13}$

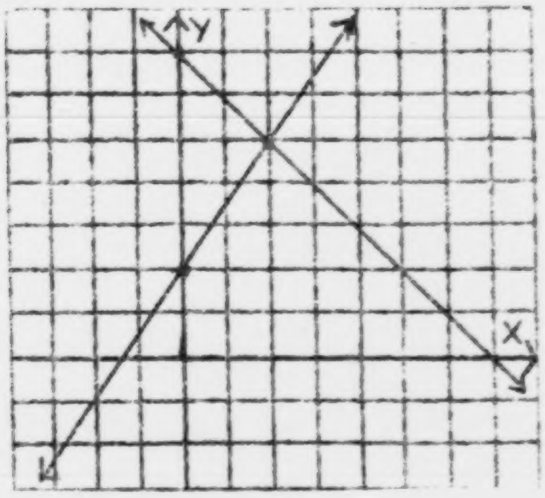
UNIT I

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

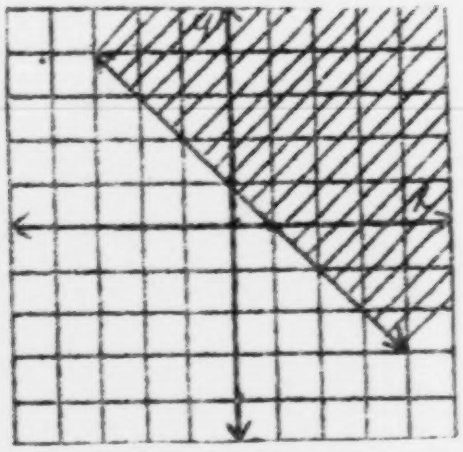
PART II
Test A

1. (5)

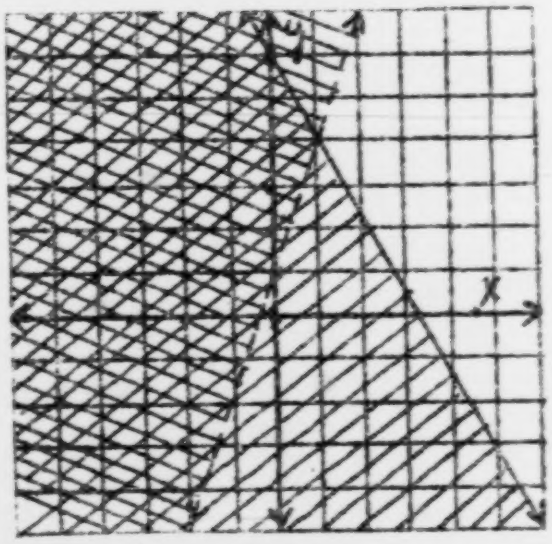


2.	(2, 5)	(5)
3.	$(-1, \frac{2}{3})$	(5)
4.	(9, 0)	(5)
5.	(-4, -6)	(5)
6.	(3, 1)	(5)
7.	46	(6)
8.	0	(6)
9.	A	(7)
10.	D	(7)
11.	-78	(6)

12. (9)



13. (9)



Acceptable Score $\frac{9}{13}$

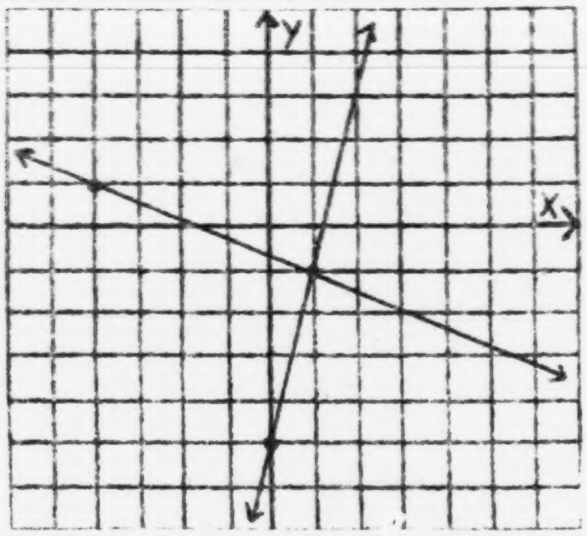
UNIT I

TEACHER'S ANSWER KEY

PART II
Test B

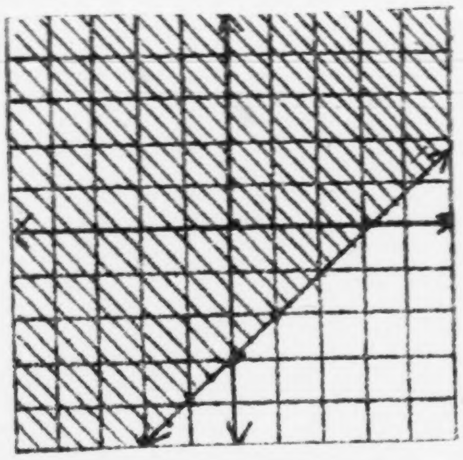
SECOND YEAR ALGEBRA

1. (5)

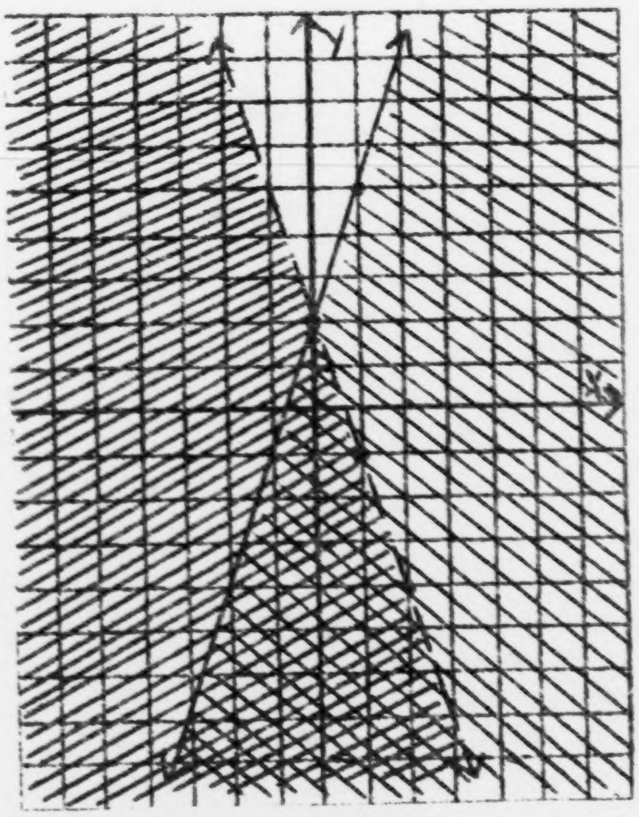


2.	(1, -1)	(5)
3.	(27, 7)	(5)
4.	$(\frac{1}{3}, \frac{1}{4})$	(5)
5.	(2, 3)	(5)
6.	(-2, -3)	(5)
7.	-20	(6)
8.	-2	(6)
9.	B	(7)
10.	D	(7)
11.	46	(6)

12. (9)



13. (9)

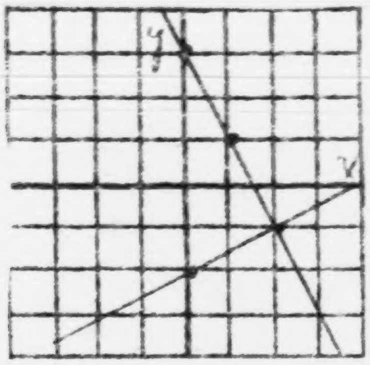


Acceptable Score $\frac{9}{13}$

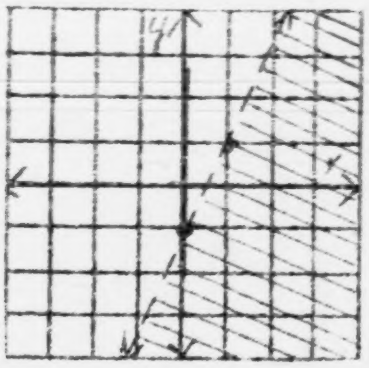
UNIT I TEACHER'S ANSWER KEY PART II
Test C

SECOND YEAR ALGEBRA

1. (5)



12. (9)



2. (2,-1) (5)

3. (4,3) (5)

4. $(\frac{1}{3}, \frac{1}{4})$ (5)

5. $(\frac{44}{3}, \frac{19}{9})$ (5)

6. $(0, -\frac{3}{2})$ (5)

7. -36 (6)

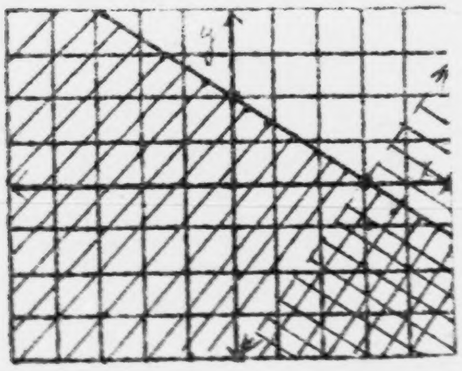
8. -23 (6)

9. D (7)

10. A (7)

11. 26 (6)

13. (9)



Acceptable Score $\frac{9}{13}$

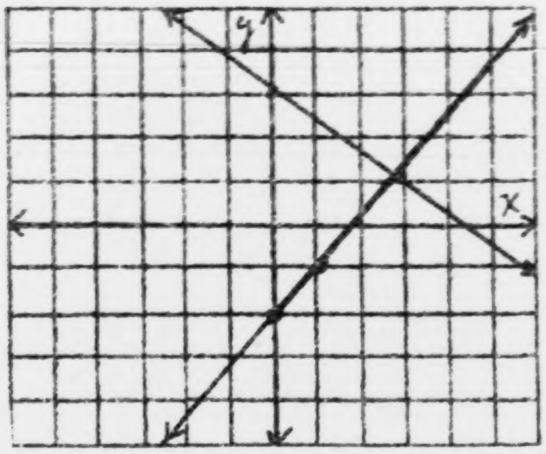
UNIT I

TEACHER'S ANSWER KEY

PART II
Test D

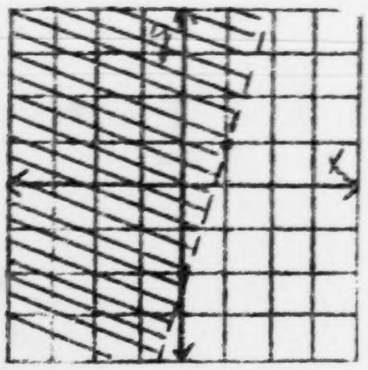
SECOND YEAR ALGEBRA

1. (5)

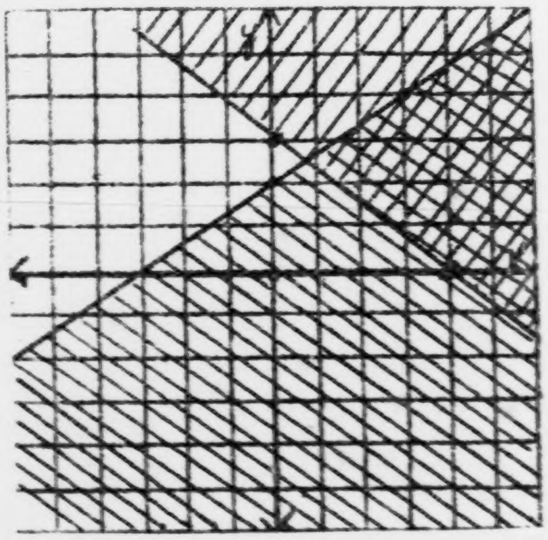


2.	(3,1)	(5)
3.	(2,-2)	(5)
4.	(1,1)	(5)
5.	(5,1)	(5)
6.	(-1,3)	(5)
7.	-26	(6)
8.	26	(6)
9.	D	(7)
10.	A	(7)
11.	82	(6)

12. (9)



13. (9)



Acceptable Score $\frac{35}{49}$

UNIT II TEACHER'S ANSWER KEY Test A

SECOND YEAR ALGEBRA

1.	b	(10)
2.	1	(10)
3.	4	(10)
4.	$x + 1$	(10)
5.	1	(10)
6.	x^6	(10)
7.	$\frac{9}{16}$	(10)
8.	a^4b^4	(10)
9.	$3a^3$	(10)
10.	x^{10}	(10)
11.	$\frac{1}{y^4}$	(10)
12.	c^8	(10)
13.	d^6	(10)
14.	$-12a^9$	(10)
15.	$45a^5b^2c^2$	(10)
16.	$-4a^5b^5c^2$	(10)
17.	$-6a^2b^2c$	(10)
18.	$\frac{2z^3}{y^3}$	(10)
19.	$4x^2z^6$	(10)
20.	$-36x^5$	(10)
21.	3^{5a}	(10)
22.	a	(10)
23.	Distributive	(11)
24.	$-6x^5 + 9x^2y - 6x^2$	(11)
25.	$6x^2 - 11x - 35$	(11)
26.	d	(11)
27.	$4x^2 - y^2$	(11)
28.	$9x^2 + 6xy + y^2$	(11)
29.	$x^3 + 1$	(11)
30.	$\{1, 2, 3, 4, 6, 12\}$	(12)
31.	12	(12)
32.	72	(12)
33.	$(2x + 3y)(2x - 3y)$	(13)
34.	$(2x + y)^2$	(13)
35.	$2y(2x^2 + 5x - 2)$	(13)
36.	$(x - 7)(x - 4)$	(15)
37.	$(x - 3)(x - 1)$	(15)
38.	$(x + 6)(x - 2)$	(15)
39.	$(3x + 5)(2x + 1)$	(15)
40.	$(y + 1)(x + a)$	(14)
41.	$(x + 2)(x^2 - 2x + 4)$	(14)

42. $(2x - 3y)(4x^2 + 6xy + 9y^2)$ (14)

43. $2(x + 5)(x - 5)$ (13)

44. $3y(x + 1)(x^2 - x + 1)$ (13,14)

45. False (16)

46. C (16)

47. D (16)

48. True (17)

49. $x^2 - 2x + 9 - \frac{22}{x + 2}$ (17)

Acceptable Score $\frac{35}{49}$

UNIT II

TEACHER'S ANSWER KEY

Test B

SECOND YEAR ALGEBRA

1.	b	(10)
2.	1	(10)
3.	6	(10)
4.	1 + b	(10)
5.	1	(10)
6.	a^{15}	(10)
7.	$-\frac{1}{8}$	(10)
8.	x^5y^5	(10)
9.	$9a^2$	(10)
10.	m^{16}	(10)
11.	$\frac{1}{x^3}$	(10)
12.	x^9	(10)
13.	m^{26}	(10)
14.	$-6b^6$	(10)
15.	$-14x^7y^2z^3$	(10)
16.	$-9m^7n^3p^2$	(10)
17.	$-3a^2b^3c$	(10)
18.	$\frac{-3cd^3}{2b}$	(10)
19.	$\frac{16x^2z^6}{y^2}$	(10)
20.	$-54a^5 - 12a^7$	(10)
21.	5^{6m}	(10)
22.	b	(10)
23.	Distributive	(11)
24.	$-4a^5 + 8a^3b - 2a^3$	(11)
25.	$6x^2 + 19x - 7$	(11)
26.	a	(11)
27.	$3x^2 + 2xy - y^2$	(11)
28.	$4x^2 + 12xy + 9y^2$	(11)
29.	$a^3 - 1$	(11)
30.	{1, 3, 5, 15}	(12)
31.	8	(12)
32.	80	(12)

33.	$(4x + 3y)(4x - 3y)$	(13)
34.	$(3x + y)^2$	(13)
35.	$5y(3x^3 + 6x^2 - 1)$	(13)
36.	$(x - 8)(x - 4)$	(15)
37.	$(x - 6)(x - 1)$	(15)
38.	$(x + 7)(x - 3)$	(15)
39.	$(5x + 1)(2x + 3)$	(15)
40.	$(3a + 2x)(a + 1)$	(14)
41.	$(x + 3)(x^2 - 3x + 9)$	(14)
42.	$(3x - 2y)(9x^2 + 6xy + 4y^2)$	(14)
43.	$3(x + 6)(x - 6)$	(13)
44.	$2y(x + 2)(x^2 - 2x + 4)$	(13,14)
45.	False	(16)
46.	a	(16)
47.	b	(16)
48.	True	(17)
49	$x^2 - 3x + 10 + \frac{-39}{x + 3}$	(17)

Acceptable Score $\frac{35}{49}$

UNIT II | TEACHER'S ANSWER KEY | Test C

SECOND YEAR ALGEBRA

1.	a	(10)
2.	1	(10)
3.	-5	(10)
4.	$2a - 1$	(10)
5.	1	(10)
6.	a^{12}	(10)
7.	$\frac{1}{9}$	(10)
8.	r^5s^5	(10)
9.	$-8m^3$	(10)
10.	x^{11}	(10)
11.	$\frac{1}{a^2}$	(10)
12.	y^5	(10)
13.	k^{20}	(10)
14.	$-12x^7$	(10)
15.	$-18a^3b^5c^7$	(10)
16.	$-2r^{13}s^5t$	(10)
17.	$-3xy^3z$	(10)
18.	$\frac{-6p^3q}{m^5}$	(10)
19.	$\frac{27a^6c^3}{-8b^6}$	(10)
20.	$144x^6 + 108x^7$	(10)
21.	3^{5m}	(10)
22.	b^2	(10)
23.	Distributive	(11)
24.	$-12a^5 + 9a^2b + 6a^2$	(11)
25.	$8y^2 - 14y - 15$	(11)
26.	C, D	(11)
27.	$2m^2 - mn - n^2$	(11)
28.	$9a^2 - 24ab + 16b^2$	(11)
29.	$x^3 + 1$	(11)
30.	$\{1, 2, 3, 6, 9, 18\}$	(12)
31.	8	(12)
32.	120	(12)

33. $(4a - 3b)(4a + 3b)$ (13)

34. $(2r + s)^2$ (13)

35. $5n(3m^3 + 6m^2 - 1)$ (13)

36. $(c - 7)(c - 4)$ (15)

37. $(y - 6)(y - 1)$ (15)

38. $(z + 6)(z - 2)$ (15)

39. $(5y + 1)(2y + 3)$ (15)

40. $(a + x)(b + 1)$ (14)

41. $(a + 3)(a^2 - 3a + 9)$ (14)

42. $(2m - 3n)(4m^2 + 6mn + 9n^2)$ (14)

43. $3(y + 6)(y - 6)$ (13)

44. $3c(b + 1)(b^2 - b + 1)$ (13,14)

45. False (16)

46. C (16)

47. A (16)

48. True (17)

49. $a^2 - 3a + 10 + \frac{-39}{a + 3}$ (17)

Acceptable Score $\frac{35}{49}$

UNIT II — TEACHER'S ANSWER KEY — Test D

SECOND YEAR ALGEBRA

1.	b	(10)
2.	1	(10)
3.	3	(10)
4.	1 + y	(10)
5.	1	(10)
6.	w^6	(10)
7.	$\frac{16}{9}$	(10)
8.	x^4z^4	(10)
9.	$27a^3$	(10)
10.	x^7	(10)
11.	$\frac{1}{a^3}$	(10)
12.	r^7	(10)
13.	c^{11}	(10)
14.	$-18a^{10}$	(10)
15.	$28a^5b^2c^2$	(10)
16.	$-9a^3b^7c^2$	(10)
17.	$-5x^2bc^2$	(10)
18.	$\frac{4z^3}{w^5}$	(10)
19.	$\frac{64a^2c^6}{9b^2}$	(10)
20.	$75x^5 - 135x^7$	(10)
21.	5^{7a}	(10)
22.	b^2	(10)
23.	Distributive	(11)
24.	$-10x^5 + 10x^3y - 15x^3$	(11)
25.	$10x^2 - 7x - 12$	(11)
26.	a	(11)
27.	$9x^2 + 6xy + y^2$	(11)
28.	$9a^2 + 6ab + b^2$	(11)
29.	$x^3 - 2x + 1$	(11)
30.	{1, 2, 4, 8, 16}	(12)
31.	24	(12)
32.	144	(12)

33. $(2a + 3d)(2a - 3d)$ (13)

34. $(3r + s)^2$ (13)

35. $2y(2x^2 + 5x - 2)$ (13)

36. $(w - 3)(w - 4)$ (15)

37. $(a - 3)(a - 1)$ (15)

38. $(b + 7)(b - 3)$ (15)

39. $(3r + 5)(2r + 1)$ (15)

40. $(3x + 2y)(x + 1)$ (14)

41. $(a + 2)(a^2 - 2a + 4)$ (14)

42. $(2c - 3d)(4c^2 + 6cd + 9d^2)$ (14)

43. $2(z + 5)(z - 5)$ (13)

44. $2b(a + 2)(a^2 - 2a + 4)$ (13,14)

45. False (16)

46. e (16)

47. b (16)

48. True (17)

49. $a^2 - 2a + 9 + \frac{-22}{a + 2}$ (17)

Acceptable Score $\frac{21}{31}$

UNIT III

TEACHER'S ANSWER KEY

PART I
Test A

SECOND YEAR ALGEBRA

1.	$\frac{1}{5^3}$	(18)
2.	a^2	(18)
3.	a^3	(18)
4.	$\frac{5}{b^3}$	(18)
5.	$\frac{1}{4a^2}$	(18)
6.	r^2t^3	(18)
7.	$\frac{x^2}{y^3}$	(18)
8.	$\frac{5}{a^2b^3}$	(18)
9.	$\frac{6x^2d^4}{y^3}$	(18)
10.	False	(18)
11.	c	(19)
12.	c	(19)
13.	0	(19)
14.	$\frac{3}{2}$	(19)
15.	-1, 3	(19)
16.	+4, -4	(19)
17.	$\frac{y}{z}$	(20)
18.	$\frac{c(x+y)}{d}$	(20)
19.	$\frac{x-y}{x+y}$	(20)
20.	$\frac{x}{x-2}$	(20)
21.	$\frac{27y^2}{a}$	(21)
22.	$\frac{1}{2a}$	(21)
23.	-1	(21)
24.	$\frac{y}{2a}$	(21)
25.	$\frac{2a}{a+4}$	(21)
26.	$\frac{2(a+4)}{a-2}$	(21)
27.	$\frac{3}{25}$	(19)
28.	.75	(19)
29.	$.\overline{6}$	(19)
30.	$\frac{1}{9}$	(19)
31.	$\frac{7}{33}$	(19)

Acceptable Score $\frac{21}{31}$

UNIT III

TEACHER'S ANSWER KEY

PART I
Test B

SECOND YEAR ALGEBRA

1.	$\frac{1}{4^5}$	(18)
2.	a^3	(18)
3.	x^2	(18)
4.	$\frac{6}{b^4}$	(18)
5.	$\frac{1}{27a^3}$	(18)
6.	a^2b^3	(18)
7.	$\frac{x^3}{y^2}$	(18)
8.	$\frac{7}{x^3y^5}$	(18)
9.	$\frac{5a^2c^6}{b^3}$	(18)
10.	True	(18)
11.	a	(19)
12.	c	(19)
13.	0	(19)
14.	$\frac{4}{5}$	(19)
15.	-2, 7	(19)
16.	9, -9	(19)
17.	$\frac{1}{y^2}$	(20)
18.	$\frac{a(x - y)}{b}$	(20)
19.	$\frac{x + y}{x - y}$	(20)
20.	$\frac{x}{x + 5}$	(20)
21.	$\frac{9y^2}{a^2}$	(21)
22.	$\frac{1}{3a}$	(21)
23.	$-a-2$	(21)
24.	$\frac{3a}{2y^2z}$	(21)
25.	$\frac{2x}{x - 5}$	(21)
26.	$\frac{3(a + 3)}{a - 7}$	(21)
27.	$\frac{7}{20}$	(19)
28.	.4	(19)
29.	.111...	(19)
30.	$\frac{2}{9}$	(19)
31.	$\frac{26}{99}$	(19)

Acceptable Score $\frac{21}{31}$

UNIT III

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART I
Test C

1. $\frac{10}{a^5}$ (18)
2. $4a$ (18)
3. x^2y^4 (18)
4. y^6 (18)
5. $\frac{1}{125}$ (18)
6. $\frac{15x^3}{y^3}$ (18)
7. $\frac{10}{x^4y^6}$ (18)
8. $\frac{1}{64x^3}$ (18)
9. $\frac{4c^7}{a^5b}$ (18)
10. True (18)
11. B (19)
12. D (19)
13. -5 (19)
14. $\frac{1}{3}$ (19)
15. $-5, 5$ (19)
16. $8, -8$ (19)
17. $\frac{1}{a^4}$ (20)
18. $\frac{x(a+b)^2}{y}$ (20)
19. $\frac{x-4}{x+4}$ (20)
20. $\frac{y}{y+2}$ (20)
21. $\frac{18y^2}{a^3}$ (21)
22. $\frac{4}{3}$ (21)
23. $-\frac{x+3}{x+1}$ (21)
24. $\frac{2y}{7x^2z^2}$ (21)
25. $\frac{4a}{a-7}$ (21)
26. $\frac{5(x-2)}{x+6}$ (21)
27. $\frac{27}{100}$ (19)
28. .1875 (19)
29. .8333... (19)
30. $\frac{5}{9}$ (19)
31. $\frac{5}{11}$ (19)

Acceptable Score $\frac{21}{31}$

UNIT III

TEACHER'S ANSWER KEY

PART I
Test D

SECOND YEAR ALGEBRA

1.	$\frac{5}{x^2}$	(18)
2.	$10a^3$	(18)
3.	x^3y^5	(18)
4.	z^7	(18)
5.	$\frac{1}{16}$	(18)
6.	$\frac{20x}{y^4}$	(18)
7.	$\frac{-5}{x^2y^7}$	(18)
8.	$\frac{1}{32x^5}$	(18)
9.	$\frac{6z^4}{x^3y^2}$	(18)
10.	True	(18)
11.	B	(19)
12.	D	(19)
13.	0	(19)
14.	$-\frac{1}{3}$	(19)
15.	7, -7	(19)
16.	10, -10	(19)
17.	$\frac{1}{x^3}$	(20)
13.	$\frac{a(x+y)^4}{b}$	(20)
19.	$\frac{y+7}{y-7}$	(20)
20.	$\frac{a}{a+7}$	(20)
21.	$\frac{10a^2x}{3}$	(21)
22.	$\frac{4(a-3)}{3(a+3)}$	(21)
23.	$-\frac{(y+1)(y+5)}{(y-5)(y-5)}$	(21)
24.	$\frac{2y}{5x^3}$	(21)
25.	$\frac{5x^2}{x-8}$	(21)
26.	$\frac{(x-8)(x-2)}{(x+8)(x-1)}$	(21)
27.	$\frac{33}{100}$	(19)
28.	.625	(19)
29.	.222...	(19)
30.	$\frac{4}{9}$	(19)
31.	$\frac{4}{11}$	(19)

Acceptable Score $\frac{10}{16}$

UNIT III

TEACHER'S ANSWER KEY

PART II
Test A

SECOND YEAR ALGEBRA

1.	$6x^3y^2$	(22)
2.	$(x - 3)(x + 3)(x - 2)$	(22)
3.	$\frac{5a - 2b}{7}$	(22a)
4.	$\frac{-5a + 6b}{12}$	(22a)
5.	$\frac{4a - 7b + 3ab}{a^2b^2}$	(22a)
6.	$\frac{3y - 2}{(y + 2)(y - 4)}$	(22a)
7.	$\frac{5y + 16}{(y + 4)(y + 6)}$	(22a)
8.	$\frac{a^2 + b^2 + a - 3}{a^2 - b^2}$	(22a)
9.	5	(23)
10.	$\frac{1}{x^2}$	(23)
11.	y	(23)
12.	$\{24\}$	(24)
13.	$\{\frac{6}{7}\}$	(24)
14.	$\{(-3, 4)\}$	(24)
15.	$\{5\}$	(26)
16.	ϕ	(26)

Acceptable Score $\frac{10}{16}$

UNIT III

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART II
Test B

1.	$12a^3b^2$	(22)
2.	$2(x + 2)(x - 2)$	(22)
3.	$\frac{7x + y}{6}$	(22a)
4.	$-\frac{31}{18}$	(22a)
5.	$\frac{5a}{8}$	(22a)
6.	$\frac{5x + 11}{(x - 2)(x + 5)}$	(22a)
7.	$\frac{4xy}{(x - y)(x + y)}$	(22a)
8.	$\frac{4x^2 + 22x + 12}{(x - 2)(x + 2)^2}$	(22a)
9.	$-\frac{1}{4}$	(23)
10.	xy	(23)
11.	$\frac{y^2 + 2y + 1}{y^2 - 2y + 1}$	(23)
12.	$\{12\}$	(24)
13.	$\{\frac{19}{3}\}$	(24)
14.	$\{(5, 0)\}$	(24)
15.	$\{\frac{1}{2}\}$	(26)
16.	$\{0\}$	(26)

Acceptable Score $\frac{10}{16}$

UNIT III

TEACHER'S ANSWER KEY

PART II
Test C

SECOND YEAR ALGEBRA

1.	$10x^2y^3$	(22)
2.	$(x - 4)(x + 4)(x + 2)$	(22)
3.	$\frac{11x - 5y}{4}$	(22a)
4.	$\frac{14a - 3b}{36}$	(22a)
5.	$\frac{10a^2 + 3ab - 7b^2}{a^2b^2}$	(22a)
6.	$\frac{10a + 32}{(a - 4)(a + 5)}$	(22a)
7.	$\frac{13a + 27}{(a - 6)(a + 1)}$	(22a)
8.	$\frac{3x^2 - 22x^2 + 9x}{(x - 3)^2(x + 3)}$	(22a)
9.	$-\frac{3}{25}$	(23)
10.	$\frac{1 + y}{y^2}$	(23)
11.	$\frac{x - 2}{(x + 2)(x - 1)}$	(23)
12.	$\{15\}$	(24)
13.	$\{\frac{23}{24}\}$	(24)
14.	$\{(0, -5)\}$	(24)
15.	$\{\frac{1}{2}\}$	(26)
16.	$\{9\}$	(26)

Acceptable Score $\frac{10}{16}$

UNIT III

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART II
Test D

1.	$36c^4d^3$	(22)
2.	$(x + 5)(x - 5)(x + 9)$	(22)
3.	$\frac{a^2 + 3ab + 2b^2}{ab}$	(22a)
4.	$\frac{-6x^2 + 13xy - 2y^2}{6xy}$	(22a)
5.	$\frac{4bc - 5ac + 7ab}{a^2b^2c^2}$	(22a)
6.	$\frac{10x + 64}{(x + 4)(x + 8)}$	(22a)
7.	$\frac{-8x^2 + 2xy + 6y^2}{(3x + y)(2x - y)}$	(22a)
8.	$\frac{6a^2 + 9ab + 3b^2 + 5}{a^2 - b^2}$	(22a)
9.	$\frac{1}{11}$	(23)
10.	$\frac{b^2 - ab}{ab^2 - a}$	(23)
11.	$\frac{y - 2}{y + 2}$	(23)
12.	$\{13\}$	(24)
13.	$\{\frac{5}{3}\}$	(24)
14.	$\{(0, -27)\}$	(24)
15.	$\{\frac{1}{2}\}$	(26)
16.	$\{3\}$	(26)

Acceptable Score $\frac{18}{25}$

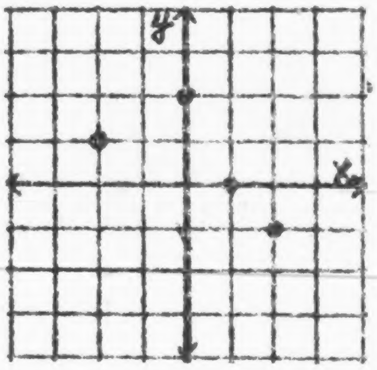
UNIT IV

TEACHER'S ANSWER KEY

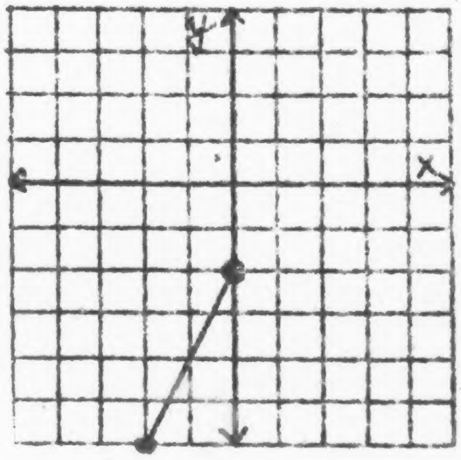
PART I
Test A

SECOND YEAR ALGEBRA

1. Function (27)
2. Function (27)
3. Relation (27)
4. $\{6, 3, 4, 5\}$ (28)
5. $\{2, 0, -1\}$ (28)
6. $\{-3, -2, -1, 0, 1, 2, 3\}$ (28)
7. $\{0, 1, 2, 3\}$ (28)
8. $\{x \mid 0 \leq x < 2\}$ (28)
9. Relation (28)
10. $\{x \mid x \neq 2, x \neq -2\}$ (28)
11. (28)



12. (28)



13. 1 (28)
14. 5 (28)
15. 12 (28)
16. 4 (28)
17. $y = 3x$ (30)
18. False (29)
19. Constant (29)
20. False (29)
21. Quotient (29)
22. $\frac{1}{4}$ or 1:4 (29)
23. 5 and 4 (29)
24. 4 (29)
25. $\rho = 4s$ or $\rho = ks$ (29)

Acceptable Score $\frac{18}{25}$

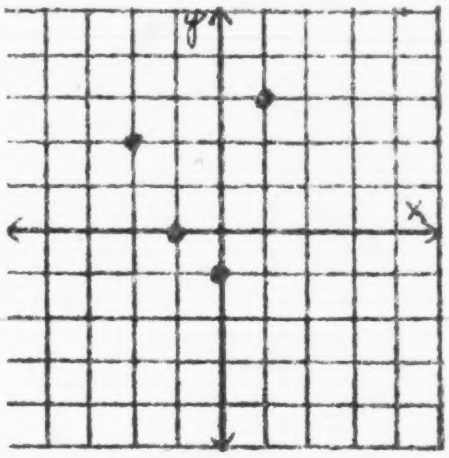
UNIT IV

TEACHER'S ANSWER KEY

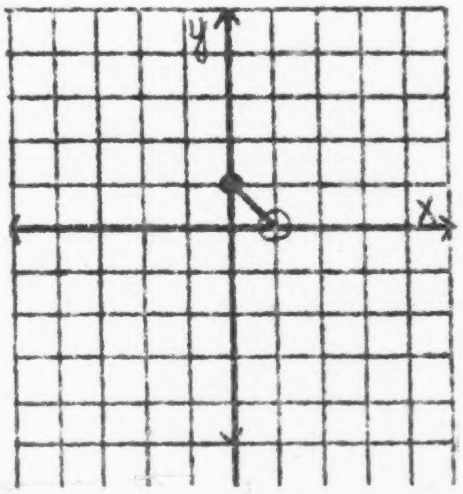
PART I
Test B

SECOND YEAR ALGEBRA

1. Relation (27)
2. Function (27)
3. Function (27)
4. $\{6, -3, 0, 5\}$ (28)
5. $\{2, 1, 8, 1\}$ (28)
6. $\{-4, -3, -2, -1, 0, 1, 2\}$ (28)
7. $\{0, 1, 2, 3, 4\}$ (28)
8. $\{ y \quad 0 < y \leq 3\}$ (28)
9. Relation (28)
10. $\{x \mid x \neq 3,\ x \neq -3\}$ (28)
11. (28)



12. (28)



13. 2 (28)
14. -1 (28)
15. 1 (28)
16. 9 (28)
17. $y = 2x$ (30)
18. False (29)
19. Constant (29)
20. True (29)
21. Ratios (29)
22. $\frac{1}{2}$ or 1:2 (29)
23. 2 and 10 (29)
24. 4 (29)
25. $p = 4s$ (29)

Acceptable Score $\frac{18}{25}$

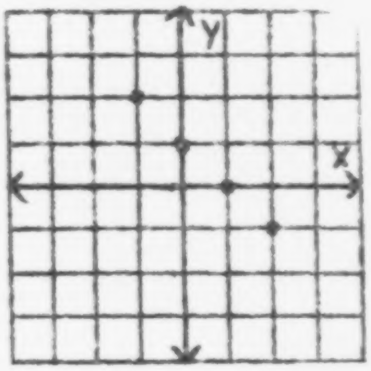
UNIT IV

TEACHER'S ANSWER KEY

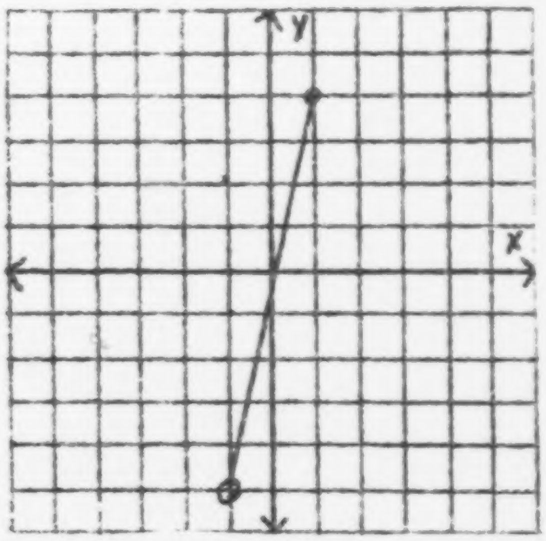
PART I
Test C

SECOND YEAR ALGEBRA

1. Relation (27)
2. Function (27)
3. Function (27)
4. $\{-3, -1, 1, 3\}$ (28)
5. $\{-1, 1, 3, 5\}$ (28)
6. $\{-3, -2, -1, 0, 1, 2, 3, 4\}$ (28)
7. $\{-2, -1, 2\}$ (28)
8. $\{y \mid -3 < y \leq 3\}$ (28)
9. Function (28)
10. $\{x \mid x \neq 5,\ x \neq -5\}$ (28)
11. (28)



12. (28)



13. 2 (28)
14. -7 (28)
15. -1 (28)
16. -9 (28)
17. $y = x + 3$ (30)
18. True (29)
19. Constant (29)
20. False (29)
21. Quotient (29)
22. $\frac{1}{2}$ (29)
23. 3, 5 (29)
24. -4 (29)
25. $P = 4s$ or $P = ks$ (29)

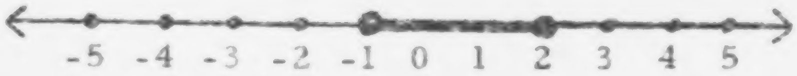
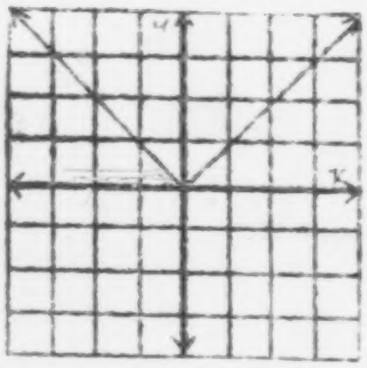
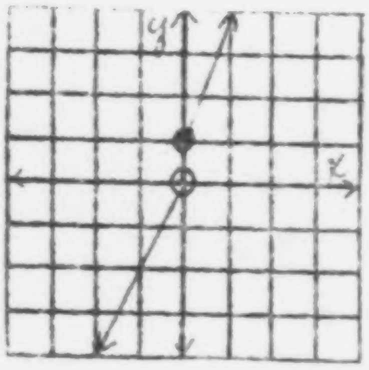
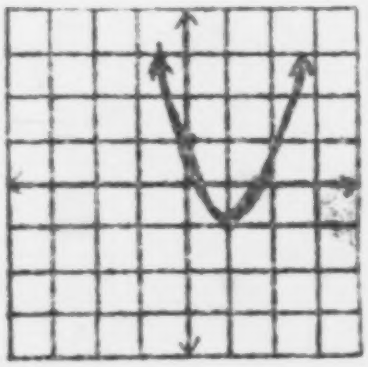
Acceptable Score $\frac{14}{20}$

UNIT IV

TEACHER'S ANSWER KEY

PART II
Test A

SECOND YEAR ALGEBRA

1.	8	(31)
2.	{7, -7}	(31)
3	{3, 1}	(31)
4.		(31)
5.	ϕ	(31)
6.		(32)
7		(32)
8	b	(33)
9	Parabola	(33)
10	Downwards	(33)
11.	False	(33)
12	x = 2	(34)
13.	b	(34)
14	(-1, -3)	(34)
15	x = -1	(34)
16	Downwards	(34)
17.	16	(34)
18	x = 1	(35)
19	(1, -1)	(35)
20.		(35)

Acceptable Score $\frac{14}{20}$

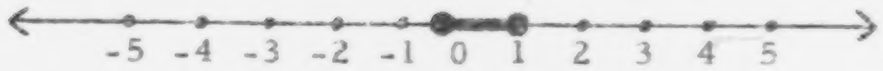
UNIT IV

TEACHER'S ANSWER KEY

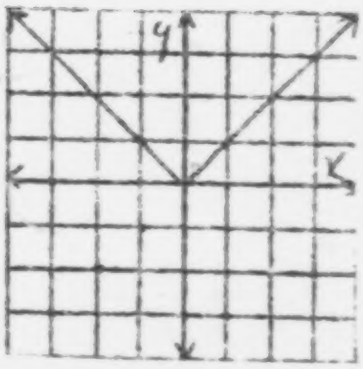
PART II
Test B

SECOND YEAR ALGEBRA

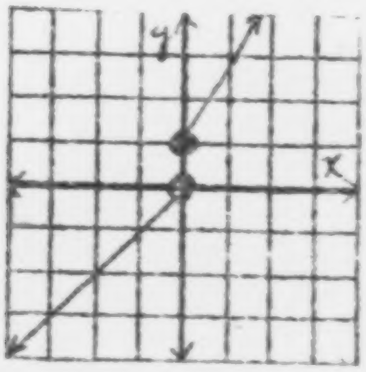
1. 16 (31)
2. $\{3, -3\}$ (31)
3. $\{3, -1\}$ (31)
4. (31)



5. $\{0\}$ (31)
6. (32)

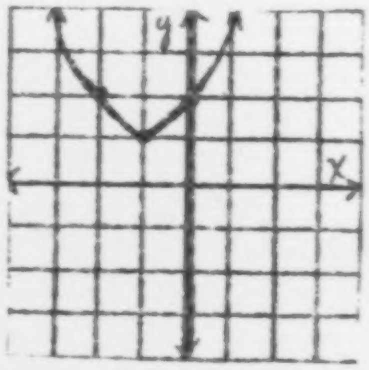


7. (32)



8. b (33)
9. Parabola (33)
0. Upwards (33)
1. True (33)
2. $x = 1$ (34)
3. b (34)

14. $(3, 1)$ (34)
15. $x = 3$ (34)
16. Upwards (34)
17. 4 (34)
18. $x = -1$ (35)
19. $(-1, 1)$ (35)
20. (35)



Acceptable Score $\frac{14}{20}$

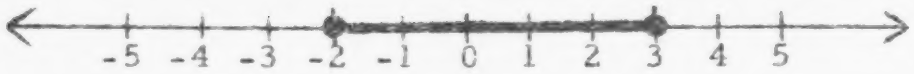
UNIT IV

TEACHER'S ANSWER KEY

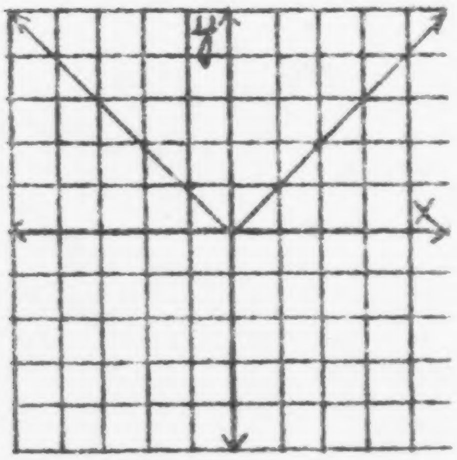
PART II
Test C

SECOND YEAR ALGEBRA

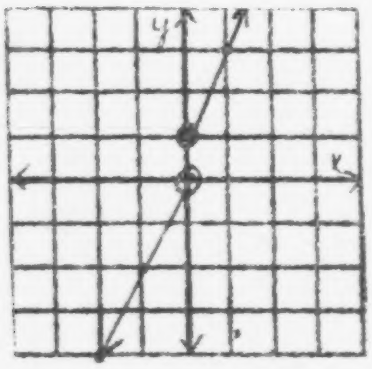
1. 10 (31)
2. {6, -6} (31)
3. {6, -4} (31)
4. (31)



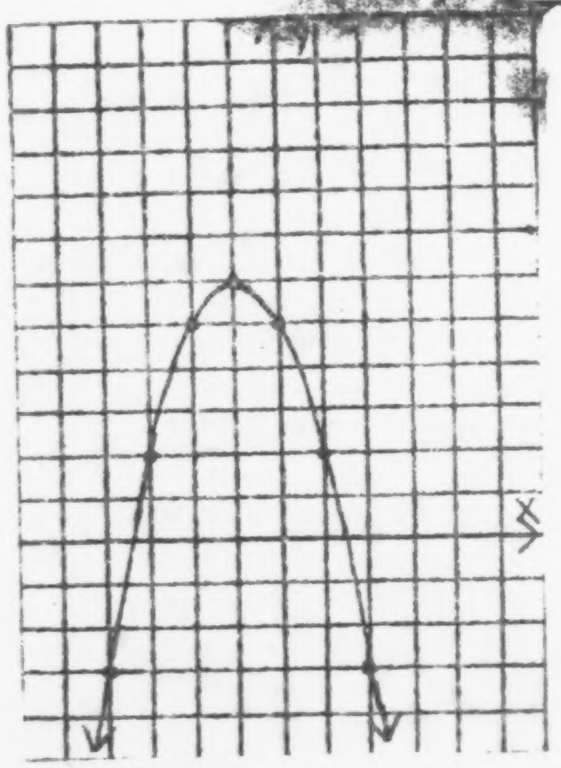
5. φ (31)
6. (32)



7. (32)



8. D (33)
9. Parabola (33)
10. Downward (33)
11. True (33)
12. x = 2 (34)
13. c (34)
14. (-1, -3) (34)
15. x = -1 (34)
16. Upward (34)
17. 4 (34)
18. x = -1 (35)
19. (-1, 6) (35)
20.



Acceptable Score $\frac{18}{23}$

UNIT V

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART I
Test A

1.	B	(36)
2.	A	(36)
3.	C	(36)
4.	D	(36)
5.	False	(36)
6.	False	(36)
7.	True	(36)
8.	7	(36)
9.	4	(36)
10.	$-\frac{1}{3}$	(36)
11.	0	(36)
12.	2	(36)
13.	.6	(36)
14.	A, D	(36)
15.	A	(36)
16.	6	(36)
17.	-2	(36)
18.	3	(36)
19.	11	(36)
20.	$\{\sqrt[5]{12}\}$	(36)
21.	$\{3, -3\}$	(36)
22.	False	
23.	True	
24.	True	
25.	$\sqrt{5}$	(37)
26.	D	(37)
27.	False	
28.	False	

Acceptable Score $\frac{13}{23}$

UNIT V

TEACHER'S ANSWER KEY

PART I
Test B

SECOND YEAR ALGEBRA

1.	C	(36)
2.	D	(36)
3.	B	(36)
4.	D	(36)
5.	True	(36)
6.	False	(36)
7.	False	(36)
8.	4	(36)
9.	5	(36)
10.	$-\frac{1}{2}$	(36)
11.	2	(36)
12.	0	(36)
13.	.5	(36)
14.	B, C	(36)
15.	B	(36)
16.	2	(36)
17.	-3	(36)
18.	5	(36)
19.	10	(36)
20.	$\{\pm 3\}$	(36)
21.	$\{-\sqrt[3]{4}\}$	(36)
22.	True	
23.	False	
24.	True	
25.	D	(37)
26.	E	(37)
27.	False	
28.	True	

Acceptable Score $\frac{18}{28}$

UNIT V

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART I
Test C

1.	A	(36)
2.	B	(36)
3.	C	(36)
4.	D	(36)
5.	False	(36)
6.	True	(36)
7.	True	(36)
8.	3	(36)
9.	-2	(36)
10.	$\frac{1}{2}$	(36)
11.	-1	(36)
12.	.07	(36)
13.	$\frac{1}{3}$	(36)
14.	B, C	(36)
15.	B	(36)
16.	2	(36)
17.	-3	(36)
18.	1000	(36)
19.	17	(36)
20.	$\{5, -5\}$	(36)
21.	$\{\sqrt[3]{3}\}$	(36)
22.	True	
23.	True	
24.	True	
25.	D	(37)
26.	E	(37)
27.	False	
28.	True	

Acceptable Score $\frac{23}{33}$

UNIT V

TEACHER'S ANSWER KEY

PART II
Test A

SECOND YEAR ALGEBRA

1.	$\frac{37}{99}$	(39)
2.	$\frac{13}{84}$	(39)
3.	B	(39)
4.	False	(39)
5.	True	(39)
6.	Irrational	(37)
7.	A	(39)
8.	True	
9.	False	
10.	$\sqrt{5}$	(40)
11.	$\sqrt[r]{a}$	(40)
12.	$\sqrt[5]{a^3}$	(40)
13.	$3^{\frac{1}{3}}$	(40)
14.	$\frac{3b^4}{a^{\frac{1}{2}}}$	(40)
15.	$84^{\frac{1}{3}} a^{\frac{5}{3}} b^2$	(40)
16.	4	(40)
17.	$\frac{1}{625}$	(40)
18.	$\sqrt[5]{5}$	(40)
19.	$\sqrt{3}$	(40)
20.	$2\sqrt{2}$	(40)
21.	$\sqrt{2}$	(40)
22.	$2\sqrt{3}$	(41)
23.	$2xy\sqrt[3]{4y}$	(41)
24.	$2\sqrt{6x}$	(41)
25.	$3\sqrt{2}$	(41)
26.	$\sqrt{\frac{14}{2}}$	(41)
27.	$\frac{2\sqrt{2y}}{3y}$	(41)
28.	$\frac{\sqrt[3]{4x}}{6x^2}$	(41)
29.	$-4\sqrt[5]{2}$	(41)
30.	$\frac{y\sqrt[6]{y^5x^5}}{x^2}$	(41)
31.	$12x^2$	(41)
32.	$\vert a - 5 \vert$	(41)
33.	$h = 32$	(40)

Acceptable Score $\frac{23}{33}$

UNIT V

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART II
Test B

1.	$\frac{23}{99}$	(39)
2.	$\frac{17}{144}$	(39)
3.	D	(39)
4.	True	(39)
5.	True	(39)
6.	Irrational	(37)
7.	B	(39)
8.	False	
9.	True	
10.	$\sqrt{7}$	(40)
11.	$\sqrt[r]{b}$	(40)
12.	$\sqrt[5]{b^4}$	(40)
13.	$5^{\frac{1}{2}}$	(40)
14.	$\frac{16^{\frac{1}{2}} y^4}{x^{\frac{1}{2}}}$ or $\frac{4y^4}{x^{\frac{1}{2}}}$	(40)
15.	$54^{\frac{1}{3}} x^{\frac{5}{3}} b^2$ or $3 \cdot 2^{\frac{1}{3}} x^{\frac{5}{3}} b^2$	(40)
16.	16	(40)
17.	$\frac{1}{81}$	(40)
18.	$\sqrt[6]{5}$	(40)
19.	$\sqrt[3]{6}$	(40)
20.	$2\sqrt{2}$	(40)
21.	$\sqrt{2}$	(40)
22.	$3\sqrt{2}$	(41)
23.	$2xy\sqrt[3]{5y^2}$	(41)
24.	$2\sqrt{5x}$	(41)
25.	$2\sqrt{3}$	(41)
26.	$\frac{\sqrt{30}}{3}$ or $\frac{1}{3}\sqrt{30}$	(41)
27.	$\frac{2\sqrt{3x}}{5x}$ or $\frac{2}{5x}\sqrt{3x}$	(41)
28.	$\frac{\sqrt[3]{r}}{2r^2}$ or $\frac{1}{4r^2}\sqrt[3]{r^2}$	(41)
29.	$-8\sqrt[5]{2}$	
30.	$\frac{x}{y^2}\sqrt[5]{x^3y^3}$	(41)
31.	$6x^2\sqrt{2}$	(41)
32.	$\lvert x - 3 \rvert$	(41)
33.	$b = \pm 2\sqrt[4]{2}$	(40)

Acceptable Score $\frac{23}{33}$

UNIT V

TEACHER'S ANSWER KEY

PART II
Test C

SECOND YEAR ALGEBRA

1. $\frac{46}{99}$ (39)
2. $\frac{11}{60}$ (39)
3. C (39)
4. True (39)
5. False (39)
6. Irrational (37)
7. C (39)
8. False
9. True
10. $\sqrt[4]{6}$ (40)
11. $\sqrt[r]{c}$ (40)
12. $\sqrt[3]{c^2}$
13. $9^{\frac{1}{4}}$ (40)
14. $\frac{5y^5}{x^{\frac{3}{2}}}$ (40)
15. $16^{\frac{1}{3}} x^{\frac{7}{3}} y^{\frac{5}{3}}$ or $2 \cdot 2^{\frac{1}{3}} x^{\frac{7}{3}} y^{\frac{5}{3}}$ (40)
16. 4 (40)
17. $\frac{1}{81}$ (40)
18. $\sqrt[5]{5}$ (40)
19. $\sqrt[3]{6}$ (40)
20. $2\sqrt{2}$ (40)
21. $\sqrt{2}$ (40)
22. $2\sqrt{3}$ (41)
23. $2xy\sqrt[3]{5y^2}$ (41)
24. $2\sqrt{6x}$ (41)
25. $2\sqrt{3}$ (41)
26. $\frac{\sqrt{14}}{2}$ (41)
27. $\frac{2\sqrt{3x}}{5x}$ or $\frac{2}{5x}\sqrt{3x}$ (41)
28. $\frac{\sqrt[3]{4x}}{6x^2}$ (41)
29. $-8\sqrt[5]{2}$ (41)
30. $\frac{y\sqrt[6]{y^5x^5}}{x^2}$ (41)
31. $6x^2\sqrt{2}$ (41)
32. $|a - 5|$ (41)
33. $b = 64$ (40)

Acceptable Score $\frac{17}{23}$

UNIT V

TEACHER'S ANSWER KEY

PART III
Test A

SECOND YEAR ALGEBRA

1.	E	(42)
2.	$6\sqrt{3}$	(42)
3.	$3\sqrt{6}$	(42)
4.	$7y^2\sqrt{2}$	(42)
5.	$24 - 20\sqrt{3}$	(43)
6.	$51 + \sqrt{11}$	(43)
7.	$5\sqrt{3} + \sqrt{7}$	(43)
8.	$\frac{12\sqrt{7} + 18}{19}$	(43)
9.	$\frac{5 - \sqrt{10}}{3}$	(43)
10.	B	(44)
11.	C	(44)
12.	A	(44)
13.	$4x^2 - 5x + 3 = 0$	(44)
14.	B	(44)
15.	$\{-1, -6\}$	(44)
16.	$\{\frac{1}{2}, -\frac{1}{4}\}$	(44)
17.	$\{1, \frac{2}{5}\}$	(44)
18.	$\frac{5}{3}$	
19.	$-\frac{5}{4}$	(45)
20.	$x^2 - 3x - 10 = 0$	(45)
21.	$\{26\}$	(46)
22.	$\{3\}$	(46)
23.	$\{3\}$	(46)

Acceptable Score $\frac{17}{23}$

UNIT V

TEACHER'S ANSWER KEY

PART III
Test B

SECOND YEAR ALGEBRA

1.	B	(42)
2.	$4\sqrt{6}$	(42)
3.	$\sqrt{3} + 3\sqrt{2}$	(42)
4.	$-114x\sqrt{x}$	(42)
5.	$3\sqrt{35} - 6\sqrt{5}$	(43)
6.	$8 + 2\sqrt{15}$	(43)
7.	$\sqrt{6} - 2$	(43)
8.	$+3(\sqrt{5} - 2)$	(43)
9.	$\frac{3(\sqrt{7} + \sqrt{5})}{2}$	(43)
10.	A	(44)
11.	C	(44)
12.	C	(44)
13.	$3x^2 - 7x - 4 = 0$	(44)
14.	B	(44)
15.	$\{-1, -3\}$	(44)
16.	$\frac{3 \pm \sqrt{41}}{4}$	(44)
17.	$\{\frac{-2}{5}, -1\}$	(44)
18.	$\frac{7}{4}$	(45)
19.	$\frac{-5}{3}$	(45)
20.	$x^2 - 4x - 21 = 0$	(45)
21.	$\{82\}$	(46)
22.	$\{2\}$	(46)
23.	$\{9\}$	(46)

Acceptable Score $\frac{17}{23}$

UNIT V

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART III
Test C

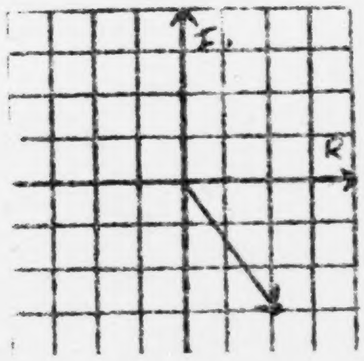
1.	C	(42)
2.	$-6\sqrt{6}$	(42)
3.	$\sqrt{2}$	(42)
4.	$7y^2\sqrt{2}$	(42)
5.	$12\sqrt{6} - 30\sqrt{2}$	(43)
6.	$13 + 2\sqrt{30}$	(43)
7.	$\sqrt{5} + 3\sqrt{7}$	(43)
8.	$-\frac{5\sqrt{3} - 35}{46}$	(43)
9.	$\frac{\sqrt{14} + \sqrt{10}}{2}$	(43)
10.	C	(44)
11.	C	(44)
12.	D	(44)
13.	$9x^2 - 3x + 14 = 0$	(44)
14.	A	(44)
15.	$\{-1, 7\}$	(44)
16.	$\{\frac{1}{2}, -\frac{1}{4}\}$	(44)
17.	$\{-\frac{2}{5}, -1\}$	(44)
18.	$\frac{7}{5}$	(45)
19.	-3	(45)
20.	$x^2 + 2x - 15 = 0$	(45)
21.	$\{28\}$	(46)
22.	$\{3\}$	(46)
23.	$\{9\}$	(46)

Acceptable Score $\frac{24}{36}$

UNIT VI — TEACHER'S ANSWER KEY — Test A

SECOND YEAR ALGEBRA

1.	$\sqrt{-1}$	(47)
2.	b	(47)
3.	a	(50)
4.	$\sqrt{7}i$	(48)
5.	$2i$	(48)
6.	$3\sqrt{3}i$	(48)
7.	$-\sqrt{15}$	(48)
8.	-12	(48)
9.	$-70i$	(48)
10.	$\sqrt{3}$	(48)
11.	$\frac{-5\sqrt{2}}{4}$	(48)
12.	-2	(48)
13.	$10i$	(49)
14.	$2\sqrt{2}i$	(49)
15.	$\frac{-7\sqrt{5}i}{10}$	(49)
16.	$\{6i, -6i\}$	(49)
17.	$\{\frac{5}{4}i, -\frac{5}{4}i\}$	(49)
18.	c	(50)
19.		(52)



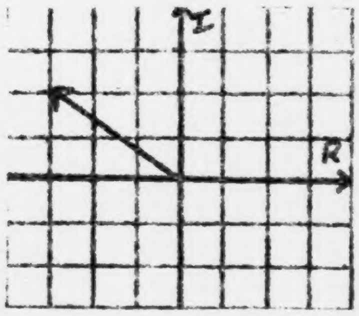
20.	False	(50)
21.	-5	(50)
22.	c	(50)
23.	0	(50)
24.	1	(51)
25.	b	(51)
26.	c	(51)
27.	$7i$	(50)
28.	29	(51)
29.	$-7 + 24i$	(51)
30.	$\frac{21}{29} - \frac{20i}{29}$	(51)
31.	False	(50)
32.	False	(52)
33.	False	(51)
34.	$\{1 + 2i, 1 - 2i\}$	(53)
35.	c	(54)
36.	b	(54)

Acceptable Score $\frac{24}{36}$

UNIT VI TEACHER'S ANSWER KEY Test B

SECOND YEAR ALGEBRA

1. $\sqrt{-1}$ (47)
2. b (47)
3. d (50)
4. $\sqrt{5}\ i$ (48)
5. 3i (48)
6. $2\sqrt{2}\ i$ (48)
7. $-\sqrt{21}$ (48)
8. -3 (48)
9. -30i (48)
10. $\sqrt{3}$ (48)
11. $\frac{3}{4}\sqrt{6}$ (48)
12. 12i (48)
13. i (49)
14. $2\sqrt{5}\,i + 2\sqrt{3}\,i$ (49)
15. $\frac{\sqrt{3}}{6}\,i$ (49)
16. {7i, -7i} (49)
17. $\{\frac{5}{2}i, \frac{-5}{2}i\}$ (49)
18. b (50)
19. (52)



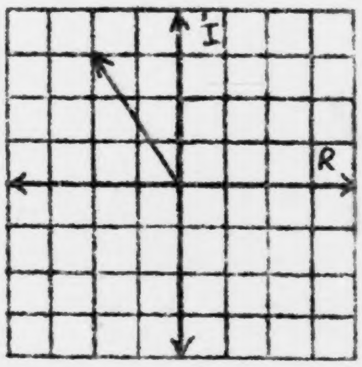
20. True (50)
21. -3 (50)
22. b (50)
23. 1 (50)
24. 0 (51)
25. c (51)
26. c (51)
27. -14 - 18i (50)
28. 13 (51)
29. -21 + 20i (51)
30. $-\frac{1}{5} - \frac{2\sqrt{6}}{5}\,i$ (51)
31. True (50)
32. False (52)
33. True (51)
34. {2 + i, 2 - i} (53)
35. b (54)
36. c (54)

Acceptable Score $\frac{24}{36}$

UNIT VI　　TEACHER'S ANSWER KEY　　Test C

SECOND YEAR ALGEBRA

1.	$\sqrt{-1}$	(47)
2.	A	(47)
3.	B	(50)
4.	$\sqrt{3}\,i$	(48)
5.	$9i$	(48)
6.	$5\sqrt{2}\,i$	(48)
7.	-8	(48)
8.	$-5\sqrt{2}$	(48)
9.	$-120i$	(48)
10.	3	(48)
11.	$\frac{-3\sqrt{10}}{10}$	(48)
12.	$20\sqrt{3}\,i$	(48)
13.	$18i$	(49)
14.	$2\sqrt{10}\,i + 2\sqrt{5}$	(49)
15.	$\left(\frac{5\sqrt{6} - 3\sqrt{5}}{15}\right) i$	(49)
16.	$\{10i, -10i\}$	(49)
17.	$\{\frac{9}{2}i, -\frac{9}{2}i\}$	(49)
18.	E	(50)
19.		(52)



20.	True	(50)
21.	-7	(50)
22.	A	(50)
23.	1	(50)
24.	0	(51)
25.	A	(51)
26.	C	(51)
27.	$-1 + 6i$	(50)
28.	28	(51)
29.	$-21 - 20i$	(51)
30.	$\frac{-7 + 6\sqrt{2}\,i}{11}$	(51)
31.	True	(50)
32.	False	(51)
33.	True	(51)
34.	$\left(\frac{5}{2} + \frac{\sqrt{3}}{2}i, \frac{5}{2} - \frac{\sqrt{3}}{2}i\right)$	(53)
35.	B	(54)
36.	C	(54)

Acceptable Score $\frac{26}{39}$

UNIT VII

TEACHER'S ANSWER KEY

Test A

SECOND YEAR ALGEBRA

1.	$b^n = a$	(55)
2.	False	(55)
3.	$\log_3 81 = 4$	(55)
4.	$\log_{\frac{1}{4}} 16 = -2$	(55)
5.	$\log_{36} 6 = \frac{1}{2}$	(55)
6.	$\log_{49}(\frac{1}{7}) = -\frac{1}{2}$	(55)
7.	$2^4 = 16$	(55)
8.	$(\frac{1}{3})^{-3} = 27$	(55)
9.	$4^{-2} = \frac{1}{16}$	(55)
10.	Yes	(55)
11.	No	(55)
12.	No	(55)
13.	$\frac{1}{2}$ pound	(56)
14.	2%	(56)
15.	.001 gram	(56)
16.	3	(56)
17.	3	(56)
18.	1	(56)
19.	2.46×10^5	(56)
20.	5.07×10^{-6}	(56)
21.	.000743	(56)
22.	120000	(56)
23.	90	(56)
24.	.9217	(57)
25.	2.9269	(57)
26.	1.5105	(57)
27.	4.7024	(57)
28.	7.1399 -10	(57)
29.	1.1897	(58)
30.	613	(57)
31.	.00847	(57)
32.	6344	(58)
33.	D	(59, 60)
34.	1266	(59)
35.	.1235	(59)
36.	51.83	(60)
37.	2.53	(60)
38.	4.07	(62)
39.	3.81	(62)

Acceptable Score $\frac{26}{39}$

UNIT VII TEACHER'S ANSWER KEY Test B

SECOND YEAR ALGEBRA

1.	$b^n = a$	(55)
2.	False	(55)
3.	$\log_5 125 = 3$	(55)
4.	$\log_{\frac{1}{3}} 27 = -3$	(55)
5.	$\log_{64} 4 = \frac{1}{3}$	(55)
6.	$\log_8 \frac{1}{2} = -\frac{1}{3}$	(55)
7.	$3^3 = 27$	(55)
8.	$36^{\frac{1}{2}} = 6$	(55)
9.	$27^{-\frac{1}{3}} = \frac{1}{3}$	(55)
10.	Yes	(55)
11.	No	(55)
12.	No	(55)
13.	.5 inches	(56)
14.	5%	(56)
15.	.01 gram	(56)
16.	3	(56)
17.	4	(56)
18.	2	(56)
19.	3.01×10^4	(56)
20.	7.05×10^{-7}	(56)
21.	3520	(56)
22.	.0809	(56)
23.	30	(56)
24.	.8621	(57)
25.	2.4200	(57)
26.	1.6464	(57)
27.	5.7810	(57)
28.	7.9309 - 10	(57)
29.	.8978	(58)
30.	29.7	(57)
31.	.0000791	(57)
32.	220.7	(58)
33.	E	(59,60)
34.	308.6	(59)
35.	6.807	(59)
36.	7,015,000	(60)
37.	1.756	(60)
38.	13.7	(62)
39.	2.47	(62)

Acceptable Score $\frac{26}{39}$

UNIT VII | TEACHER'S ANSWER KEY | Test C

SECOND YEAR ALGEBRA

1.	$b^n = a$	(55)
2.	True	(55)
3.	$\log_5 125 = 3$	(55)
4.	$\log_{-\frac{1}{3}} - 27 = -3$	(55)
5.	$\log_{49} 7 = \frac{1}{2}$	(55)
6.	$\log_8 \frac{1}{2} = -\frac{1}{3}$	(55)
7.	$3^4 = 81$	(55)
8.	$49^{-\frac{1}{2}} = \frac{1}{7}$	(55)
9.	$\log_{\frac{1}{4}} - 16 = -2$	(55)
10.	Yes	(55)
11.	No	(55)
12.	No	(55)
13.	1 ounce	(56)
14.	.5 grams	(56)
15.	.2%	(56)
16.	3	(56)
17.	4	(56)
18.	3	(56)
19.	3.25×10^4	(56)
20.	3.02×10^{-5}	(56)
21.	231,000	(56)
22.	.00801	(56)
23.	200	(56)
24.	.5786	(57)
25.	2.7101	(57)
26.	1.9309	(57)
27.	3.4800	(57)
28.	6.3096-10	(57)
29.	2.9226	(58)
30.	6.35	(57)
31.	.408	(57)
32.	742.2	(58)
33.	A	(59, 60)
34.	3.229	(59)
35.	.02468	(59)
36.	335.3	(60)
37.	2.243	(60)
38.	1.79	(62)
39.	2.26	(62)

Acceptable Score $\frac{15}{20}$

UNIT VIII

TEACHER'S ANSWER KEY

PART I
Test A

SECOND YEAR ALGEBRA

1.	B	(63)
2.	-9	(63)
3.	4	(63)
4.	3, 11, 19, 27	(63)
5.	$t_n = a + (n - 1) d$	(63)
6.	-47	(63)
7.	55	(63)
8.	6, 9, 12, 15, 18	(64)
9.	104	(65)
10.	8, 48, 88, ...	(63, 65)
11.	36	(65)
12.	D	(66)
13.	3	(66)
14.	-5, 10, -20, 40	(66)
15.	$t_n = ar^{n - 1}$	(66)
16.	C	(66)
17.	12	(67)
18.	15, 45	(67)
19.	E	(68)
20.	D	(68)

Acceptable Score $\frac{15}{20}$

UNIT VIII

TEACHER'S ANSWER KEY

PART I
Test B

SECOND YEAR ALGEBRA

1.	D	(63)
2.	11	(63)
3.	-6	(63)
4.	12, 19, 26, 33	(63)
5.	$t_n = a + (n - 1) d$	(63)
6.	-50	(63)
7.	32	(63)
8.	9, 2, -5	(64)
9.	80	(65)
10.	3, 1, -1	(63, 65)
11.	39	(65)
12.	D	(66)
13.	-2	(66)
14.	-2, -10, -50, -250	(66)
15.	$t_n = ar^{n - 1}$	(66)
16.	C	(66)
17.	12	(67)
18.	15, 75	(68)
19.	D	(68)
20.	A	(68)

Acceptable Score $\frac{15}{20}$

UNIT VIII

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART I
Test C

1.	B	(63)
2.	-7	(63)
3.	-7	(63)
4.	2, 9, 16, 23	(63)
5.	$t_n = a + (n - 1) d$	(63)
6.	-61	(63)
7.	65	(63)
8.	-14, -13, -12, -11, -10, -9, -8, -7, -6	(64)
9.	705	(65)
10.	3, 1, -1	(63, 65)
11.	72	(65)
12.	C	(66)
13.	-3	(66)
14.	9, -18, 36, -72, 144, -288	(66)
15.	$t_n = ar^{n - 1}$	(66)
16.	C	(66)
17.	12	(67)
18.	15, 75	(67)
19.	D	(68)
20.	B	(68)

Acceptable Score $\frac{7}{10}$

UNIT VIII

TEACHER'S ANSWER KEY

PART II
Test A

SECOND YEAR ALGEBRA

1. A (69)
2. $-\frac{64}{3}$ (69)
3. C (69)
4. D (70)
5. $a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$ (70)
6. B (71)
7. $210x^6y^4$ (71)
8. 1 (72)
9. 1 (72)
10. C (72)

Acceptable Score $\frac{7}{10}$

UNIT VIII

TEACHER'S ANSWER KEY

PART II
Test B

SECOND YEAR ALGEBRA

1. A (69)
2. -2 (69)
3. B (69)
4. B (70)
5. $a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$ (70)
6. D (71)
7. $462a^6b^5$ (71)
8. 1 (72)
9. 1 (72)
10. D (72)

Acceptable Score $\frac{7}{10}$

UNIT VIII

TEACHER'S ANSWER KEY

PART II
Test C

SECOND YEAR ALGEBRA

1.	A	(69)
2.	$-\frac{48}{5}$	(69)
3.	A	(69)
4.	B	(70)
5.	$a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$	(70)
6.	C	(71)
7.	$210x^4y^6$	(71)
8.	1	(72)
9.	1	(72)
10.	A	(72)

Acceptable Score $\frac{14}{20}$

UNIT IX

TEACHER'S ANSWER KEY

PART I
Test A

SECOND YEAR ALGEBRA

1.	D	(73)
2.	B	(73)
3.	D	(73)
4.	B	(73)
5.	B	(73)
6.	True	(74)
7.	n!	(74)
8.	E	(74)
9.	E	(74)
10.	120	(74)
11.	C	(75)
12.	D	(75)
13.	C	(76)
14.	B	(76)
15.	$\frac{n!}{r!\,(n-r)!}$	(76)
16.	B	(76)
17.	C	(76)
18.	A	(77)
19.	A	(78)
20.	B	(78)

Acceptable Score $\frac{14}{20}$

UNIT IX

TEACHER'S ANSWER KEY

PART I
Test B

SECOND YEAR ALGEBRA

1.	E	(73)
2.	D	(73)
3.	B	(73)
4.	B	(73)
5.	A	(73)
6.	Permutation	(74)
7.	n!	(74)
8.	C	(74)
9.	C	(74)
10.	B	(74)
11.	A	(75)
12.	D	(75)
13.	B	(76)
14.	C	(76)
15.	$\frac{n!}{n!\,(n-r)!}$	(76)
16.	A	(76)
17.	10	(76)
18.	D	(77)
19.	B	(78)
20.	B	(78)

Acceptable Score $\frac{14}{20}$

UNIT IX

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART I
Test C

1.	C	(73)
2.	B	(73)
3.	B	(73)
4.	A	(73)
5.	D	(73)
6.	True	(74)
7.	n!	(74)
8.	B	(74)
9.	A	(74)
10.	D	(74)
11.	B	(75)
12.	C	(75)
13.	C	(76)
14.	B	(76)
15.	$\frac{n!}{r!\,(n-r)!}$	(76)
16.	A	(76)
17.	C	(76)
18.	B	(77)
19.	C	(78)
20.	B	(78)

Acceptable Score $\frac{11}{16}$

UNIT IX

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART II
Test A

1.	B	(79)
2.	D	(79)
3.	C	(80)
4.	False	(80)
5.	1	(80)
6.	$\frac{1}{6}$	(80)
7.	D	(80)
8.	E	(80)
9.	P(A) + P(B)	(81)
10.	$\frac{1}{13}$	(80)
11.	$\frac{1}{2}$	(80)
12.	$\frac{10}{13}$	(80)
13.	$\frac{1}{52}$	(80)
14.	$\frac{9}{25}$	(82)
15.	$\frac{1}{3}$	(82)
16.	$\frac{6}{25}$	(82)

Acceptable Score $\frac{11}{16}$

UNIT IX

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

PART II
Test B

1.	D	(79)
2.	B	(79)
3.	D	(80)
4.	True	(80)
5.	0	(80)
6.	$\frac{1}{3}$	(80)
7.	E	(80)
8.	A	(80)
9.	$P(A) + P(B)$	(81)
10.	$\frac{1}{13}$	(80)
11.	$\frac{1}{2}$	(80)
12.	$\frac{3}{13}$	(80)
13.	$\frac{1}{52}$	(80)
14.	$\frac{4}{25}$	(82)
15.	$\frac{6}{45}$	(82)
16.	$\frac{6}{25}$	(82)

Acceptable Score $\frac{11}{16}$

UNIT IX

TEACHER'S ANSWER KEY

PART II
Test C

SECOND YEAR ALGEBRA

1.	C	(79)
2.	B	(79)
3.	B	(80)
4.	1	(80)
5.	0	(80)
6.	$\frac{1}{3}$	(80)
7.	B	(80)
8.	C	(80)
9.	$P(A) + P(B)$	(81)
10.	$\frac{1}{13}$	(80)
11.	$\frac{2}{13}$	(80)
12.	$\frac{11}{13}$	(80)
13.	$\frac{1}{52}$	(80)
14.	$\frac{6}{25}$	(82)
15.	$\frac{4}{15}$	(82)
16.	$\frac{2}{15}$	(82)

Acceptable Score $\frac{15}{22}$

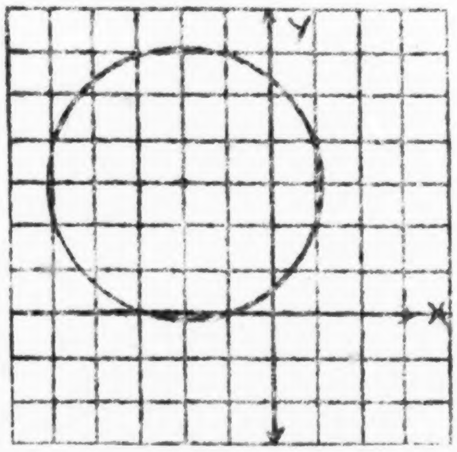
UNIT X

TEACHER'S ANSWER KEY

PART I
Test A

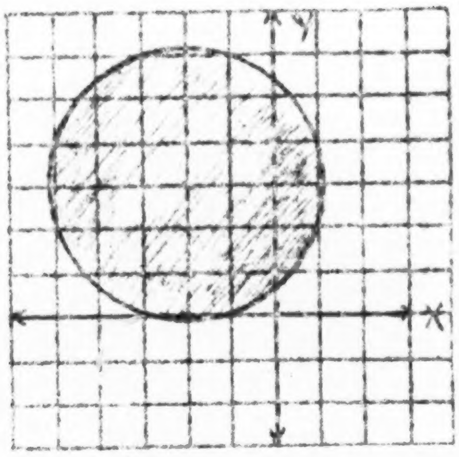
SECOND YEAR ALGEBRA

1. 8 (83)
2. 17 (83)
3. $3\sqrt{r^2 + 4s^2}$ (83)
4. $(\frac{1}{2}, 1\frac{1}{2})$ (83)
5. (-9, 5) (83)
6. True (83)
7. Circle (84)
8. $(x - 4)^2 + (y + 5)^2 = 36$ (84)
9. $(x - 5)^2 + (y + 3)^2 = 16$ (84)
10. (-2, 3) (84)
11. 3 (84)
12. (84)

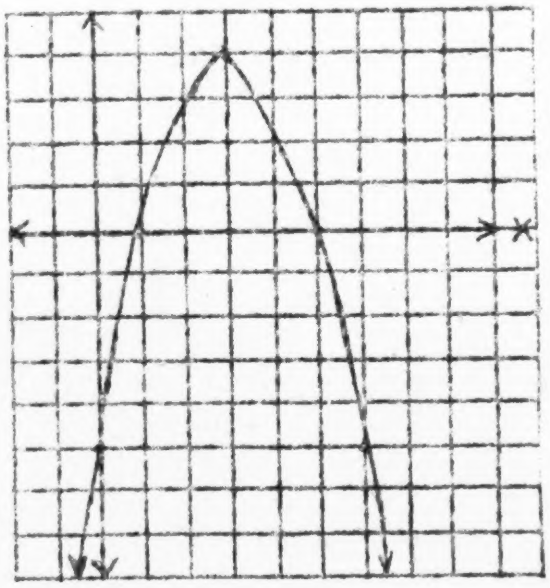


13. A (84)

14. (84)



15. $y = (x + 1)^2 - 3$ (85)
16. $x = 3$ (85)
17. (3, 4) (85)
18. Concave from below. (85)
19. Yes (85)
20. (85)



21. $y = \frac{1}{20}x^2$ (85)
22. C (85)

Acceptable Score $\frac{15}{22}$

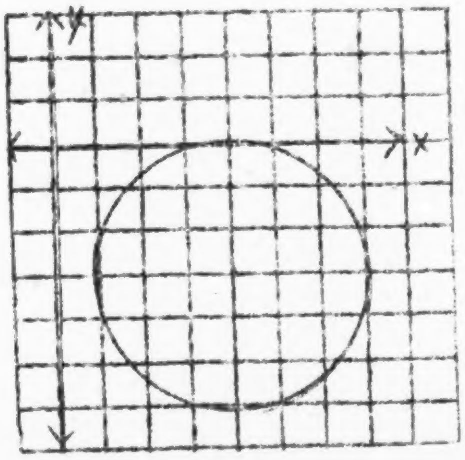
UNIT X

TEACHER'S ANSWER KEY

PART I
Test B

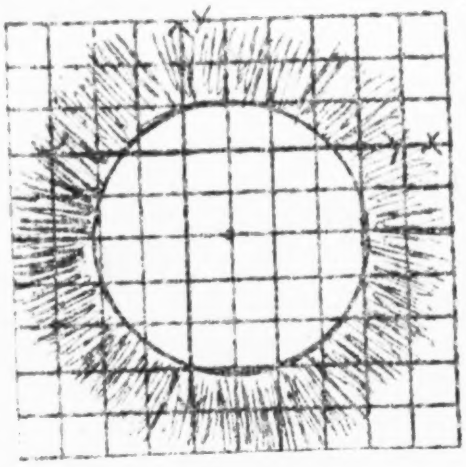
SECOND YEAR ALGEBRA

1. 6 (83)
2. 10 (83)
3. $\sqrt{9x^2 + 16y^2}$ (83)
4. $(3\frac{1}{2}, -2)$ (83)
5. (4, 6) (83)
6. False (83)
7. Circle (84)
8. $(x + 2)^2 + (y - 3)^2 = 16$ (84)
9. $(x + 8) + (y - 3)^2 = 4$ (84)
10. (4, -3) (84)
11. 3 (84)
12. (84)

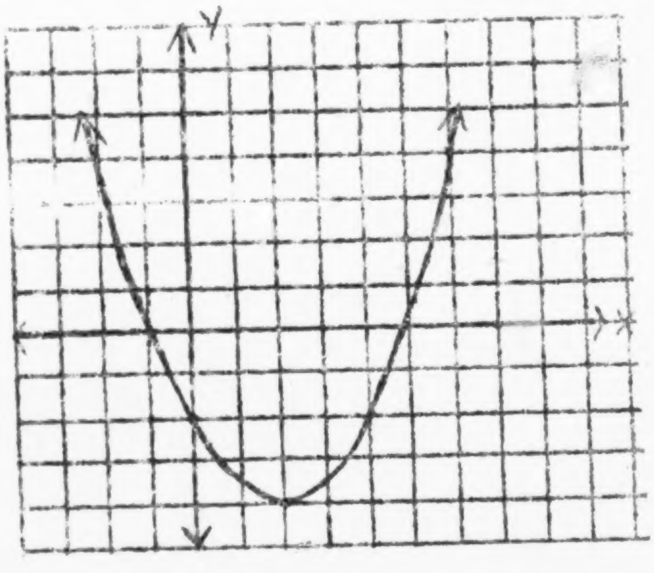


13. B (84)

14. (84)



15. $y = (x - 2)^2 - 5$ (85)
16. $x = 2$ (85)
17. (2, -4) (85)
18. Concave from above. (85)
19. No (85)
20. (85)



21. $y = \frac{1}{4}x^2 + 2$ (85)
22. B (85)

Acceptable Score $\frac{15}{22}$

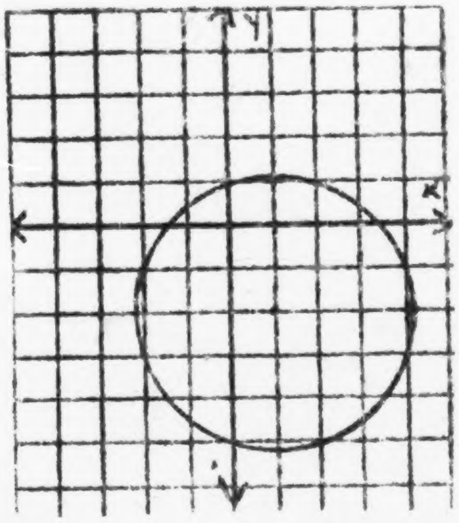
UNIT X

TEACHER'S ANSWER KEY

SECOND YEAR ALGEBRA

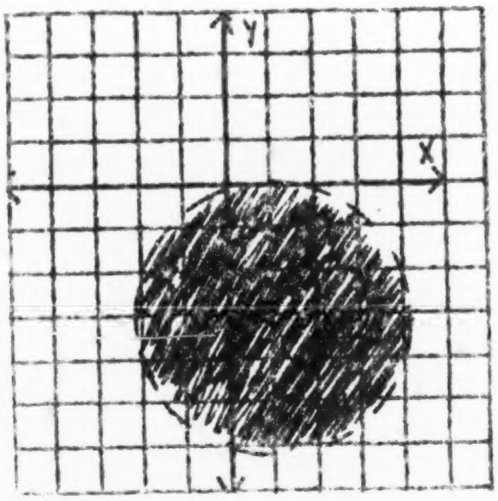
PART I
Test C

1. 10
2. $\sqrt{29}$
3. 17a
4. $(-\frac{1}{2}, 0)$
5. $(\frac{1}{2}, 4)$
6. True
7. Circle
8. $(x - 3)^2 + (y + 2)^2 = 4$
9. $(x + 3)^2 + (y - 4)^2 = 36$
10. (1, -2)
11. 3
12.

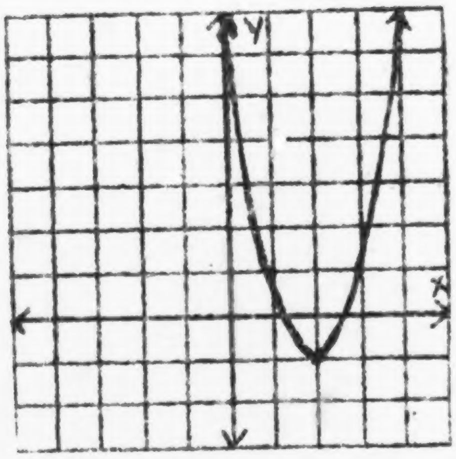


13. A

14.



15. $y = (x + 4)^2 - 18$
16. $x = 2$
17. (2, -1)
18. Upward
19. No
20.



21. $x = \frac{1}{10}y^2$
22. B

Acceptable Score $\frac{10}{14}$

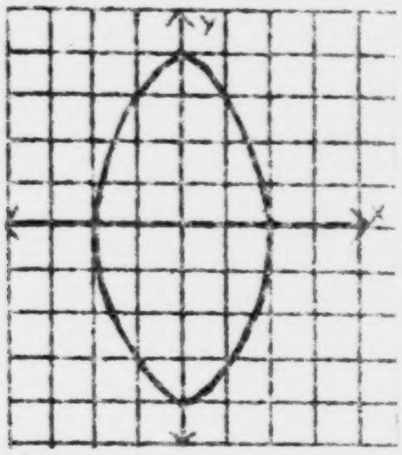
UNIT X

TEACHER'S ANSWER KEY

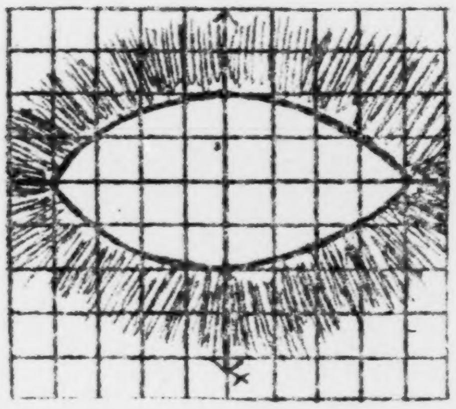
SECOND YEAR ALGEBRA

PART II
Test A

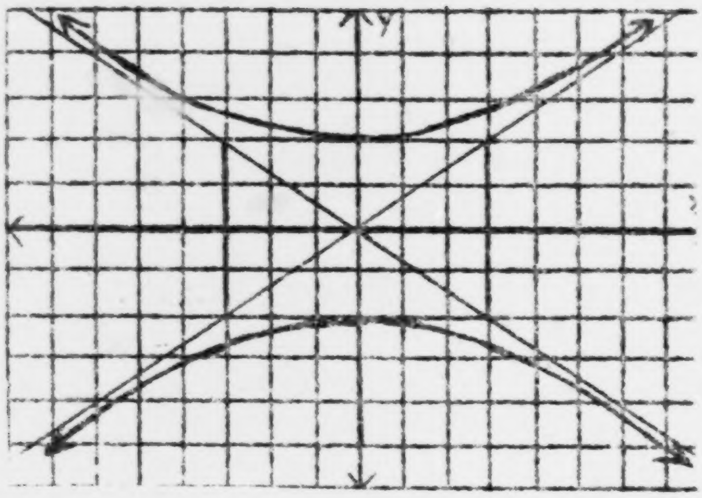
1. 2, -2 (86)
2. 4, -4 (86)
3. (86)



4. $4x^2 + 25y^2 - 100 = 0$ (86)
5. $\frac{x^2}{25} + \frac{y^2}{100} = 1$ (86)
6. $\frac{x^2}{20} + \frac{y^2}{36} = 1$ (86)
7. C (86)
8. (86)



9. (87)



10. $\frac{y^2}{4} - \frac{x^2}{49} = 1$ (87)
11. A (87)
12. Conic (87)
13. $\{(1,1);\ (-1,-1)\}$ (88, 89)
14. $\{(2,-3);\ (-2,-3);\ (3,2);\ (-3,2)\}$ (90)

Acceptable Score $\frac{10}{14}$

UNIT X

TEACHER'S ANSWER KEY

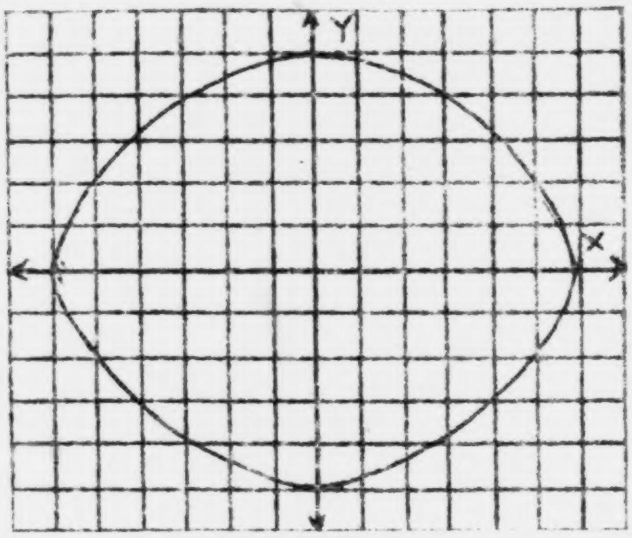
PART II
Test B

SECOND YEAR ALGEBRA

1. +6, -6 (86)

2. +5, -5 (86)

3. (86)



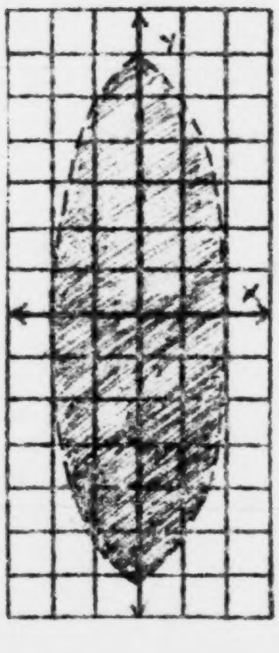
4. $9x^2 + 16y^2 - 144 = 0$ (86)

5. $\frac{x^2}{25} + \frac{y^2}{9} = 1$ (86)

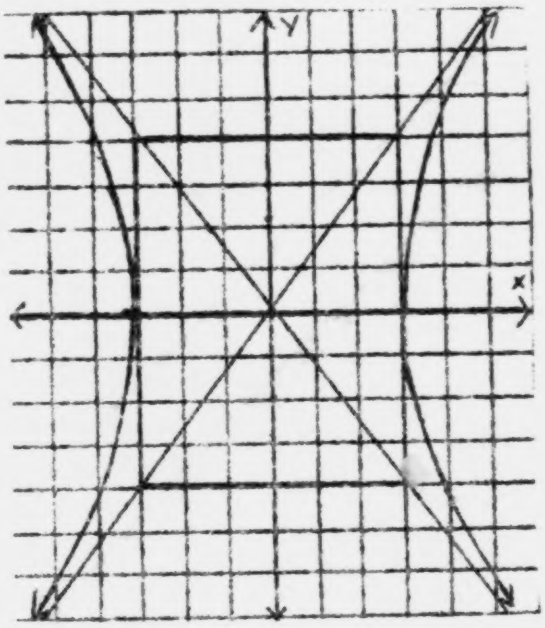
6. $\frac{x^2}{24} + \frac{y^2}{49} = 1$ (86)

7. A (86)

8. (86)



9. (87)



10. $\frac{x^2}{25} - \frac{y^2}{36} = 1$ (87)

11. C (87)

12. Conic (87)

13. $\{(-4, -4), (4, 4)\}$ (88, 89)

14. $\{(5, 4), (5, -4), (-5, 4), (-5, -4)\}$ (90)

Acceptable Score $\frac{10}{14}$

UNIT X

TEACHER'S ANSWER KEY

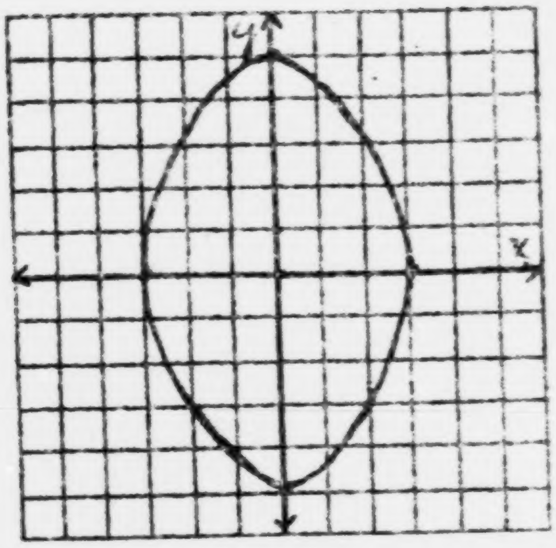
PART II
Test C

SECOND YEAR ALGEBRA

1. 3, -3 (86)

2. 5, -5 (86)

3. (86)



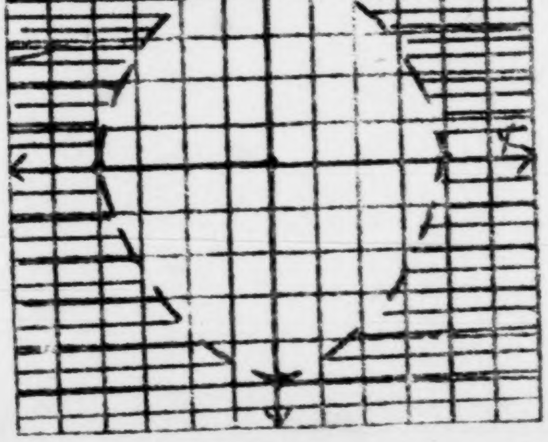
4. $4x^2 + y^2 - 16 = 0$ (86)

5. $\frac{x^2}{25} + \frac{y^2}{100} = 1$ (86)

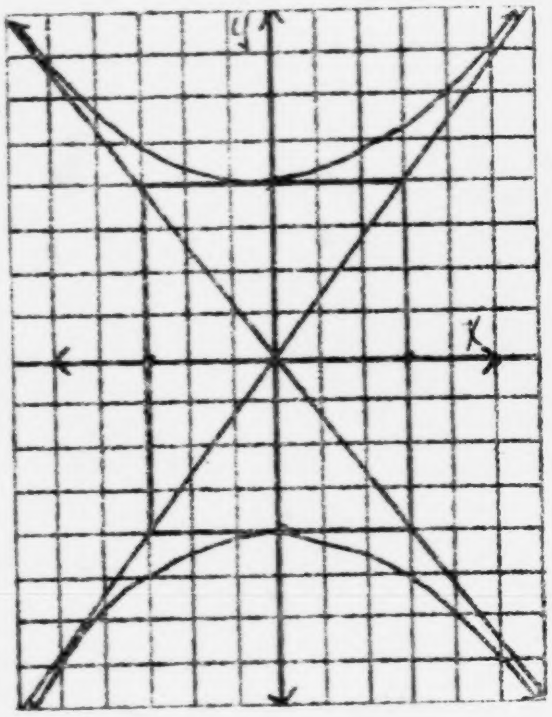
6. $\frac{x^2}{20} + \frac{y^2}{36} = 1$ (86)

7. B (86)

8. (86)



9. (87)



10. $\frac{x^2}{16} - \frac{y^2}{36} = 1$ (87)

11. B (87)

12. Conic (87)

13. $\{(-4,-4), (4,4)\}$ (88, 89)

14. $\{(2,-3), (-2,-3),$
$(3,2), (-3,2)\}$ (90)

Acceptable Score $\frac{21}{29}$

UNIT XI

TEACHER'S ANSWER KEY
SECOND YEAR ALGEBRA

Test A

1. Matrix (91)

2. 3 x 2 (91)

3. -1, 0 (91)

4. -1 (91)

5. $\begin{bmatrix} 3 & -1 & 3 \\ 4 & 0 & 7 \end{bmatrix}$ (91)

6. $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ or $0_{3 \times 1}$ (91)

7. $\begin{bmatrix} 2 & -1 \\ 7 & 7 \\ -6 & 0 \end{bmatrix}$ (92)

8. $\begin{bmatrix} 15 & -5 \\ 0 & 20 \end{bmatrix}$ (92)

9. $\begin{bmatrix} 2 & -5 & 0 \\ 6 & -3 & -1 \end{bmatrix}$ (92)

10. $\begin{bmatrix} 5 & -1 & 10 \\ 6 & -2 & -4 \end{bmatrix}$ (92)

11. $\begin{bmatrix} 2 & -3 \\ -1 & 4 \\ 0 & -1 \end{bmatrix}$ (92)

12. E (92)

13. $\begin{bmatrix} 0 & -2 \\ 2 & -3 \\ -1 & -3 \end{bmatrix}$ (92)

14. $\begin{bmatrix} 2 & 1 & 5 \\ -1 & -2 & 3 \end{bmatrix}$ (92)

15. True (93)

16. $\begin{bmatrix} 7 & 1 \\ 3 & 4 \end{bmatrix}$ (93)

17. $\begin{bmatrix} 7 & -10 \\ 11 & 11 \\ -1 & 10 \end{bmatrix}$ (93)

18. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (93)

19. A (93)

20. $\begin{vmatrix} -1 & 0 \\ 1 & 7 \end{vmatrix}$ (97)

21. False (97)

22. 19 (97)

23. Inverse (95)

24. False (95)

25. Determinant (95)

26. $\begin{bmatrix} \frac{4}{11} & \frac{-3}{11} \\ \frac{1}{11} & \frac{2}{11} \end{bmatrix}$ (95)

27. $\begin{bmatrix} 1 & 0 \\ 2 & 3 \end{bmatrix}$ (95)

28. $\begin{bmatrix} 3 & 1 \\ 1 & -2 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$ (96)

29. $\begin{bmatrix} 0 \\ 1 \end{bmatrix}$ (96)

Acceptable Score $\frac{21}{29}$

UNIT XI　　TEACHER'S ANSWER KEY　　Test B

SECOND YEAR ALGEBRA

1. Matrix (91)

2. 2 x 3 (91)

3. 4, 0 (91)

4. -3 (91)

5. $\begin{bmatrix} 2 & -3 \\ 4 & 0 \\ 7 & 1 \end{bmatrix}$ (91)

6. $\begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$ (91)

7. $\begin{bmatrix} -2 & 1 & -8 \\ 7 & -5 & 5 \end{bmatrix}$ (92)

8. $\begin{bmatrix} -10 & -5 & 25 \\ -5 & -15 & 0 \\ 35 & 0 & 20 \end{bmatrix}$ (92)

9. $\begin{bmatrix} -5 & 6 \\ -10 & 14 \end{bmatrix}$ (92)

10. $\begin{bmatrix} 4 & 0 \\ -3 & -2 \end{bmatrix}$ (92)

11. $\begin{bmatrix} 2 & 6 \\ -5 & 0 \end{bmatrix}$ (92)

12. A (92)

13. $\begin{bmatrix} -7 & 1 \\ -1 & -1 \end{bmatrix}$ (92)

14. $\begin{bmatrix} 1 & 0 & 0 \\ -\frac{1}{2} & 1 & -1 \\ \frac{1}{2} & 0 & -1 \end{bmatrix}$ (92)

15. False (93)

16. $\begin{bmatrix} 9 & 0 \\ -5 & 4 \end{bmatrix}$ (93)

17. $\begin{bmatrix} 7 & 2 & -3 \\ 0 & 3 & 2 \\ 4 & 5 & 0 \end{bmatrix}$ (93)

18. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (93)

19. A (93)

20. $\begin{bmatrix} 2 & 4 \\ -2 & 1 \end{bmatrix}$ (97)

21. True (97)

22. 1 (97)

23. Inverse (95)

24. True (95)

25. Determinant (95)

26. $\begin{bmatrix} \frac{1}{4} & -\frac{5}{4} \\ 0 & 1 \end{bmatrix}$ (95)

27. $\begin{bmatrix} 1 & -3 \\ 1 & 5 \end{bmatrix}$ (95)

28. $\begin{bmatrix} 5 & -2 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ (96)

29. $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$ (96)

Acceptable Score $\frac{21}{29}$

UNIT XI

TEACHER'S ANSWER KEY
SECOND YEAR ALGEBRA

Test C

1. Matrix (91)

2. 4 x 3 (91)

3. 4, 6, 3 (91)

4. -2 (91)

5. $\begin{bmatrix} 1 & 4 & -2 & 5 \\ -1 & 6 & 1 & 3 \\ 2 & 3 & 0 & -7 \end{bmatrix}$ (91)

6. $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ or $0_{2 \times 3}$ (91)

7. $\begin{bmatrix} 6 & 10 \\ -10 & 13 \end{bmatrix}$ (92)

8. $\begin{bmatrix} -12 & -20 \\ 20 & 0 \\ -4 & 16 \end{bmatrix}$ (92)

9. $\begin{bmatrix} -7 & 8 & 50 \\ 24 & -29 & 16 \end{bmatrix}$ (92)

10. $\begin{bmatrix} -5 & -11 \\ -5 & 6 \end{bmatrix}$ (92)

11. $\begin{bmatrix} -5 & 2 & 0 \\ -1 & -3 & 6 \\ -7 & -12 & 4 \end{bmatrix}$ (92)

12. C (92)

13. $\begin{bmatrix} 2 & 0 \\ -5 & -10 \\ -9 & 5 \end{bmatrix}$ (92)

14. $\begin{bmatrix} -\frac{1}{2} & -\frac{5}{2} \\ \frac{9}{2} & \frac{7}{2} \end{bmatrix}$ (92)

15. True (93)

16. $\begin{bmatrix} 11 & 10 \\ -2 & -1 \end{bmatrix}$ (93)

17. $\begin{bmatrix} -43 \\ 28 \\ -9 \end{bmatrix}$ (93)

18. $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ (93)

19. B (93)

20. $\begin{bmatrix} 2 & -5 \\ 5 & -3 \end{bmatrix}$ (97)

21. False (97)

22. 0 (97)

23. Identity (95)

24. False (95)

25. Zero (95)

26. $\begin{bmatrix} \frac{3}{8} & \frac{5}{8} \\ \frac{1}{4} & \frac{3}{4} \end{bmatrix}$ (95)

27. $\begin{bmatrix} \frac{3}{11} & -\frac{4}{11} \\ \frac{7}{22} & \frac{53}{22} \end{bmatrix}$ (95)

28. $\begin{bmatrix} 3 & -2 \\ 1 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 6 \end{bmatrix}$ (95)

29. $\begin{bmatrix} \frac{32}{17} \\ \frac{14}{17} \end{bmatrix}$ (96)

APPENDIX D

PROFILE SHEET

FOR

A SELF-PACING PROGRAM IN ALGEBRA

VOLUME II

STUDENT PROFILE SHEET

Name of Student: ______________________________ H. R. ______________

Subject: ______________________________ Pd. ______________

SCAT Scores: ______________________________

Quarter Grades:

I	II	H	III	IV	H	Y

Test No.	Date	Acceptable Score	Student Score	Comments	Dates of Absence

Name of Student: ____________________

Test No.	Date	Acceptable Score	Student Score	Comments	Dates of Absence

Anecdotal Record:

APPENDIX E

EVALUATION SHEET

FOR

A SELF-PACING PROGRAM IN ALGEBRA

VOLUME II

REACTIONS PLEASE

This program will only be as good as you make it. Your suggestions and criticisms are earnestly sought so that they can be included in revisions of the program.

VOLUME II

Page Number (if appropriate) Comment

Send to: Thomas E. Rowan
Supervisor of Mathematics
Maryland State Department of Education
600 Wyndhurst Avenue
Baltimore, Maryland 21210